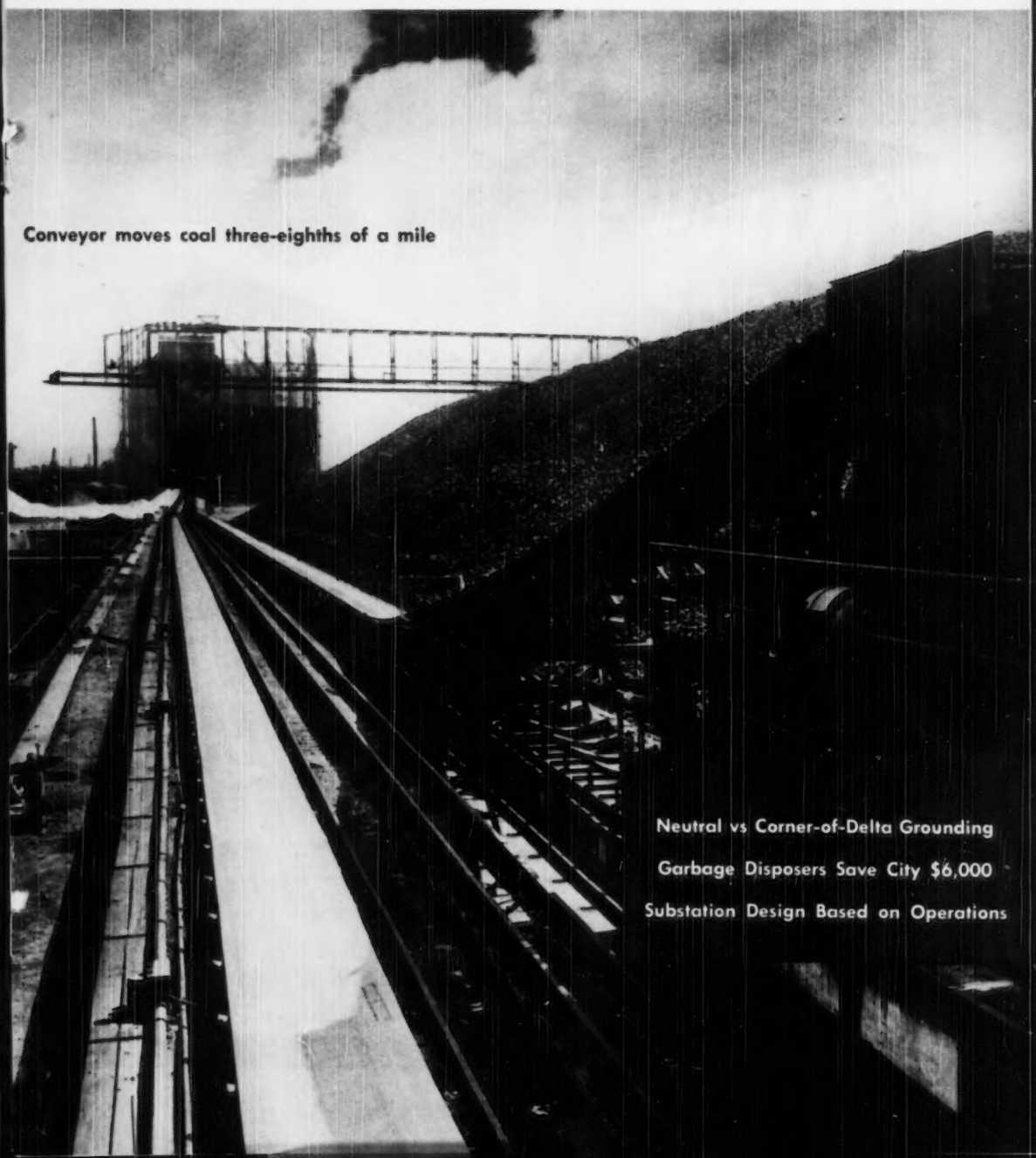
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

SEPTEMBER 25, 1950 • OUR 76th YEAR



Conveyor moves coal three-eighths of a mile

Neutral vs Corner-of-Delta Grounding

Garbage Disposers Save City $6,000

Substation Design Based on Operations

NEW!

COMPACT! ECONOMICAL!

Murray LOAD CENTERS

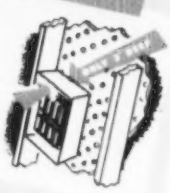
with Fully Magnetic Circuit Breakers

that are Interchangeable with Other New Single Pole Individually Housed Breakers

Now you can get all the advantages of *fully* magnetic circuit breaker protection in load centers that are trim and compact — with breakers that are interchangeable with other new single pole individually housed breakers! Now you can get utmost flexibility with minimum stock — make up your own combination right on the job! Now you can forget about "derating" . . . now you can banish the nuisance of false tripping . . . now you can make satisfactory installations of circuit breakers in warm or poorly ventilated locations—where space and cost are important!

These compact new Murray load centers are available in 2, 6 or 8 circuit models. They come equipped with the sensational new *small size* Murray fully magnetic circuit breakers — now 30 per cent smaller than previous fully magnetic circuit breakers — available in ratings of 10 through 50 amp. They save you time . . . save you trouble . . . save you money — yet assure the user positive protection combined with utmost satisfaction!

Shallower Box — only 3 inches deep—ideal for flush installation in "dry wall" construction. Plus a simple ⅜" plaster line adjustment!



See for yourself why Murray *fully* magnetic breakers can't trip from heat . . never need derating . . always carry rated load plus harmless overloads—even in warm locations and poorly ventilated panels. Clear, simple diagrams tell the story in this folder. Write for your copy today.

Murray MANUFACTURING CORPORATION

1250 ATLANTIC AVENUE • BROOKLYN 16, N. Y.

Electrical Safety Devices for Home and Industry

THE SAFETY ISSUE IS COMING

They won't know it until **Electrical World's** next regular issue comes out October 9th, but a lot of electrical industry men may find themselves minded to adopt a new attitude toward accident prevention.

The approach may be called "The Three R's of Safety." They are:

1. Routine
2. Risk
3. Remedy

Several months ago, it seemed to **Electrical World's** editors that the electrical industry would welcome a practical look at accidents and their causes. Senior Associate Editor Arch Knowlton proposed to the E.E.I. Committee on Accident Prevention that they do the job in cooperation with him.

The E.E.I. men chosen, by Chairman W. T. Rogers of Ebasco to work with us as authors are all specialists. Not only are they safety engineers, but each one stands out in accident prevention in a specific branch of industry operation: power plant, substation, transmission line, distribution, metering, etc.

They determined the typical **routine** operations, the **risks** involved in the jobs and the most logical **remedies** for preventing the mishaps.

And there are your "Three R's."

Our fond hope, and we have good reason to believe that we're not setting our sights too high, is that the Safety Issue will provide the core for new standard rule books of safety for many electric utilities. If that happens the "Three R's" might save more than one life and limb. And that is our **fondest** hope.

THE EDITORS

ELECTRICAL WORLD

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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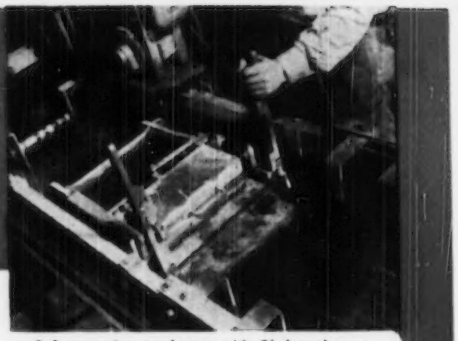
The Plus Factors which make OKOLITE-OKOPRENE Your Best Buy in Electrical Cable



Before coating conductors with Okoloy, the annealed copper wire is electrolytically cleaned, thoroughly scrubbed, wiped, rinsed and wiped again.

From the inside out, every component of Okonite cable has a *plus value* which adds to cable life. That's because the Okonite manufacturing process carries on from where conventional cable design leaves off. The finished cable is a combination of all these exclusive Okonite developments—the best that modern research and manufacturing techniques can produce.

CONDUCTORS — not "tinned", but Okoloy-coated.

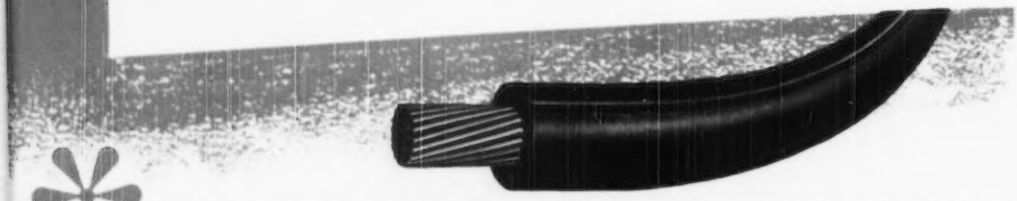
INSULATION — not just rubber, but natural Wild Up-River Fine Para rubber.

PROTECTIVE COVERING — not just another neoprene compound, but the pioneer, time-proved Okoprene formula.

PROCESSING — not the commonly used extrusion method, but the famous Okonite precision strip-process.

VULCANIZATION — not with life-shortening "double-cure", but with strength-retaining single vulcanization in a metal mold.

TESTING — not just a single voltage test, but both high voltage a-c and super-voltage d-c tests.



The Okoloy process was introduced in 1928 to offset two factors frequently encountered in tin conductor-coatings which lessen long cable life—1) tin coatings readily alloy with copper in the processing bath and, as a result, some copper always remains in contact with the rubber insulation; and 2) the sulphur contained in the rubber compounds then reacts with and destroys the tin-copper coating which in turn exposes the copper conductor, eventually causing deterioration of both the conductor and the rubber insulation.

Okoloy affords protection against both these factors because it is a lead alloy. Of all common metals, lead is least damaged by sulphur acids. Moreover, lead does not alloy with copper under the condition encountered in coating conductors. Because processing baths are not contaminated with copper the Okoloy coating is pure throughout. It adheres strongly to the copper conductor, and surrounds it with an acid-resistant, flexible coating which contributes materially to longer life of both rubber insulation and conductor.

This is only one of the six principal plus factors which contribute to the extra-long life of Okonite cables. For detailed information on OKOLOY, write for Bulletin EW—2019 to The Okonite Company, Passaic, N. J.

THE BEST CABLE IS YOUR BEST POLICY

OKONITE *insulated wires and cables*

3605

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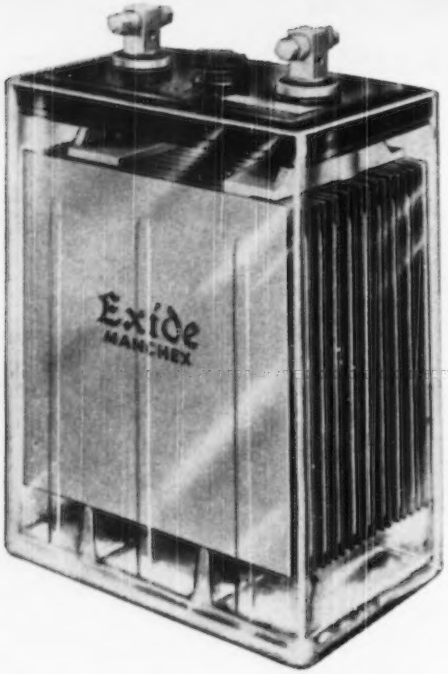
Westinghouse
PLANNED LIGHTING PAYS



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ASSURE DEPENDABLE POWER FOR SWITCHGEAR OPERATIONS

Exide-Manchex Batteries are DIFFERENT in design, construction, performance . . . differences you can count on for dependable battery service day after day . . . and at a saving.

One outstanding feature is the *famous Exide manchester positive plate*, which is used *exclusively* in the Exide-Manchex Battery. Other important features include:

. . . slotted plastic separators, impervious to chemical and electrical reaction.

. . . plastic spacers that maintain perfect plate alignment.

. . . the latest development in molded glass jars.

. . . heavy terminal posts with copper inserts for extra conductivity.

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Combined, these Exide-Manchex features assure you dependable power for positive operation of switchgear.

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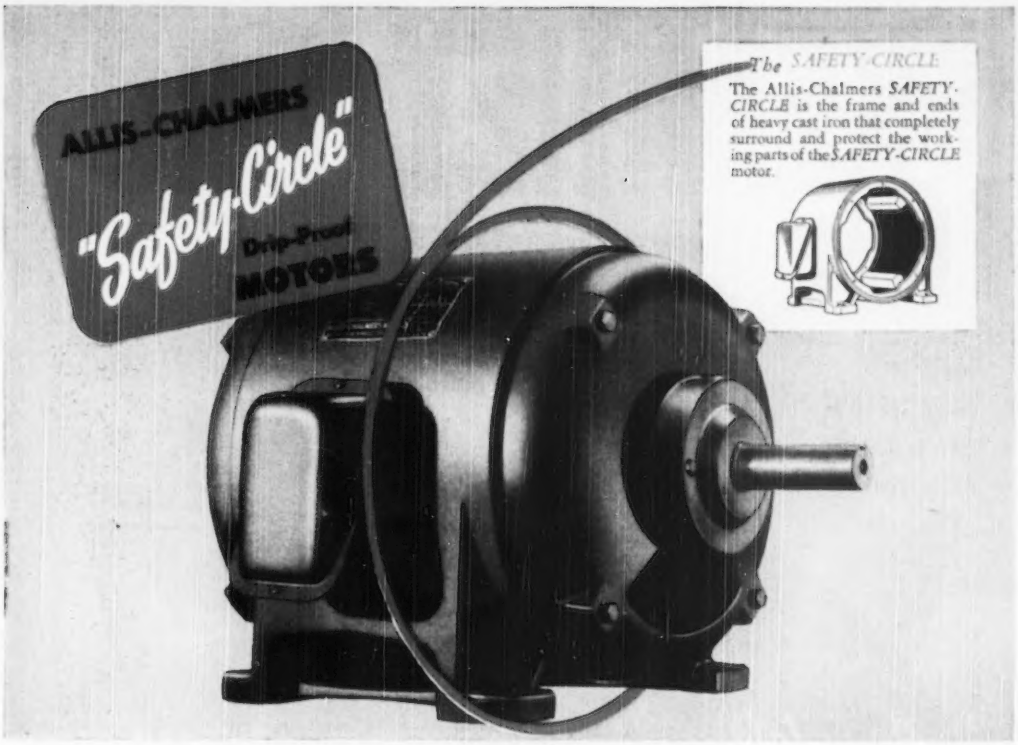
ALLIS-CHALMERS
"Safety-Circle"
Drip-Proof
MOTORS
The SAFETY-CIRCLE
The Allis-Chalmers SAFETY-CIRCLE is the frame and ends of heavy cast iron that completely surround and protect the working parts of the SAFETY-CIRCLE motor.

SAFETY-CIRCLE means

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A-3144

THE *SAFETY-CIRCLE* MOTOR is protected all around against those four great motor killers — corrosion . . . distortion . . . friction . . . foreign matter. The frame is of cast iron, the most corrosion-resistant material for this purpose.

The strength and stiffness of the cast iron is supplemented by ribbing and bracing to maintain alignment and prevent distortion. Ball bearings are lubricated and sealed at the factory. They require no attention for years. End brackets are drip-proof at no premium.

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For complete details on *SAFETY-CIRCLE* advantages, see your A-C Authorized Dealer or Sales Office or write for Bulletin 51B6210B. Stocked in sizes 1 to 20 hp. *SAFETY-CIRCLE*, *Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks.

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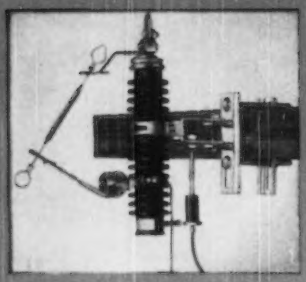

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Gives You

Complete Combined Protection

on ONE insulator

Here is the answer to the problem of transformer protection. The Trip-O-Link Fuse Cutout and the QR Arrester are combined on one insulator to minimize installation and maintenance cost, and the advanced design features of both units insure full lightning, overload and short circuit protection. Write today for complete technical data.

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BETTER CONSTRUCTION *Safer* MAINTENANCE

DEPENDABLE ALWAYS!!

Whichever the season, there's seldom any worry about overhead power lines, or customer relations either, when Simplex - ANHYDREX Self - Supporting Aerial Cables are on the job. Anhydrex insulated and neoprene jacketed, they assure trouble-free service year in and year out in any location, and their modern construction does away with the need for excessive tree-trimming.

Anhydrex has excellent electrical properties and is the most stable of all rubber insulations when exposed to water and moisture. The tough neoprene jacket withstands abrasion caused by swaying limbs and chafing against poles and it provides effective protection against fungus, heat, sunlight and weathering.

ANHYDREX Self-Supporting Aerial Cables require little or no tree trimming for installation. The circuit is entirely insulated, and the copper bindings that secure the conductors to the messenger provide a grounded path on the outside. During storms the strong supporting messenger retards line breaks due to falling limbs and ice-loading. Even when poles fall, the well-protected cables will usually continue to operate efficiently.

ANHYDREX Self-Supporting Aerial Cables are delivered ready for installation. They can be clamped to poles already standing. Crossarms and insulators are unnecessary. Few workmen and comparatively little time are needed for the job. But these are but a few of the advantages they provide. For the complete story, simply fill in and return the coupon below.

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NAME _____ TITLE _____
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Unloaded... Installed... Operating... *in only 48 hours*

Recently a large steel corporation in Kansas City, Mo., ordered this nine-frame, 600 volt I-T-E secondary distribution switchboard as part of a modernization program to replace obsolete distribution equipment and provide additional interrupting capacity.

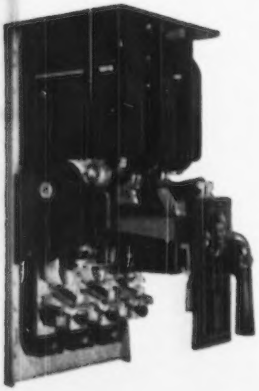
A quick changeover was essential . . .

Shortly after the switchboard arrived at a Kansas City freight yard, it was unloaded from the flat car and transferred by truck to the switchhouse, positioned relative to points of cable entry, main connections were made, and the power switch thrown—*all within 48 hours!*

This switchboard was installed easily, quickly and economically because it was *completely assembled* and *thoroughly tested* at the I-T-E factory prior to shipment. I-T-E engineered the job, supplied all components, installed all internal wiring, shipped the board as a complete unit. Only external cable connections were required after installation.

Here's proof that *you* can modernize *your* plant easily, quickly and economically. And there are many other benefits you get with I-T-E Low Voltage Switchgear. Here are a few:

- **CAREFUL APPLICATION:** I-T-E application engineers carefully apply the equipment to your needs and see that it is built to fit your requirements. All components that go into I-T-E switchboards are the finest obtainable, carefully coordinated into efficient functional units.
- **ATTRACTIVE APPEARANCE:** When you purchase other equipment you select it partly for appearance because you know how important it is to the efficiency of your personnel. Your plant personnel will react just as favorably to more attractive switchgear.
- **DEPENDABLE CIRCUIT BREAKERS:** No switchboard can be more dependable than the circuit breakers in it. I-T-E circuit breakers offer you the trouble-free protection so important to proper plant operation.



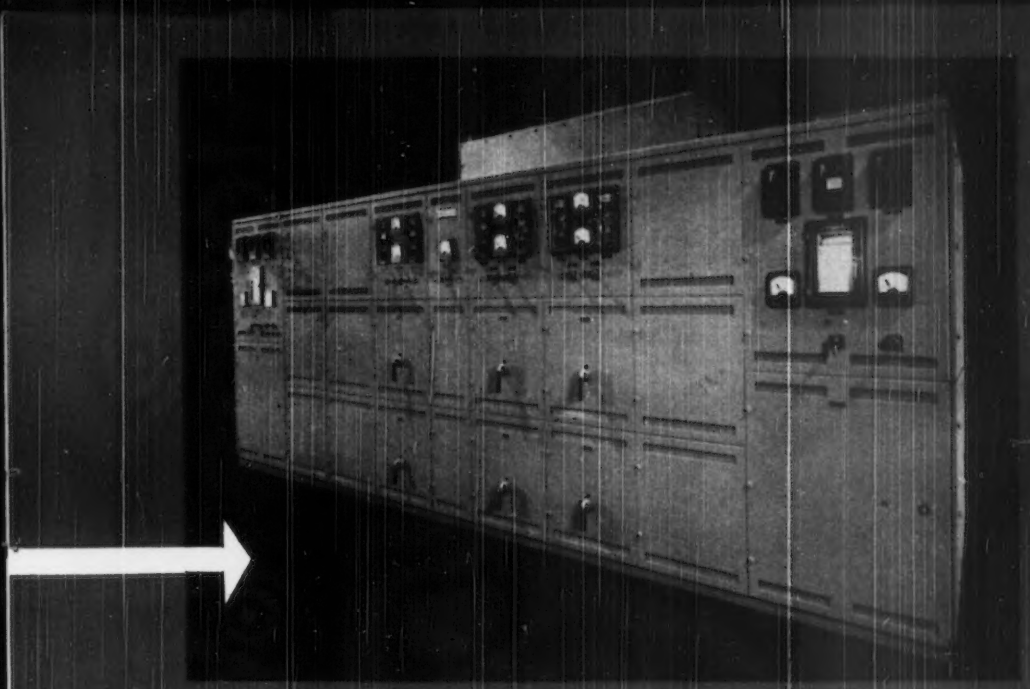
◀ *Positive-acting Air Circuit Breakers*
Type KB Breaker. 25,000 RMS Amp. Interrupting Rating. 600 Amp. Continuous Rating. 2, 3, or 4 Poles. Manually or Electrically operated.

Send for these descriptive bulletins: ▶

BULLETIN 6003-D: A complete reference guide to I-T-E 600 V. Switchgear Assemblies.

BULLETIN 7000-A: Describes I-T-E's newest 5 KV Switchgear.

Get both bulletins—ask your local I-T-E Representative, or write I-T-E General Offices.

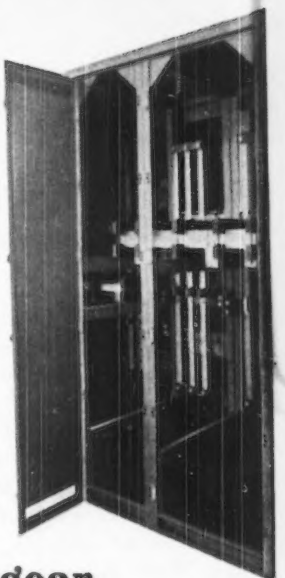


MULTUMITE SWITCHGEAR IS COMPACT . . . EFFICIENT!

The compactness of I-T-E Multumite assemblies is well illustrated in the above photo. Behind the attractive exterior of this switchboard are strong, efficient breakers and components—designed and built to provide positive protection of secondary distribution systems.

Electrically welded steel frames—one for each vertical group of breakers—are bolted together on a continuous channel-iron sill (furnished by I-T-E) to make a strong, rigid, and self-supporting structure. In addition to keeping the switchboard rigid in transit, the sill provides an excellent vermin-proof base for installation.

For extra protection of equipment, each breaker is in a separate metal compartment formed by horizontal and vertical steel barriers welded to the frame, exterior metal panels, and the metal back of breaker itself.



This bus compartment is designed for easy access ▶

Here's another reason installation of I-T-E Low Voltage Switchgear is so easy. A spacious bus compartment with a single horizontal bus facilitates cable connections, makes them easy to get to, provides more space for outgoing cables. Full-height hinged doors swing wide, can be removed easily. The whole compartment is *planned* for maximum accessibility and greater convenience!

I-T-E

R&IE

For *more dependable* Switchgear

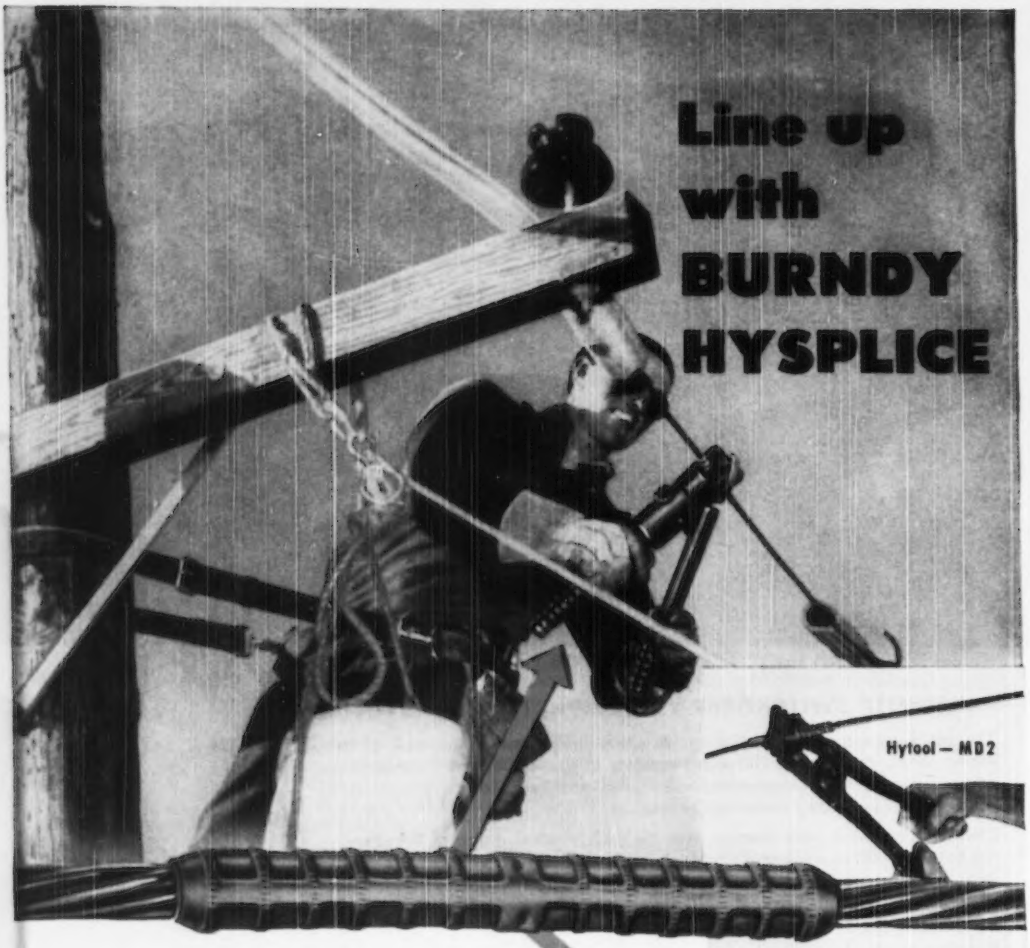
specify I-T-E!

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

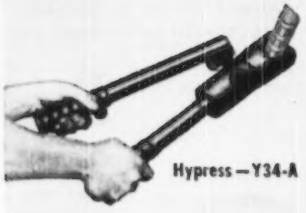
Power Switching Equipment: Railway and Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS • RESISTORS • SPECIAL PRODUCTS



Up goes the bucket with Hysplices and Hypress. Quickly, the 9-ton indenting force of the Hypress permanently joins conductor and Hysplice sleeve. The line is up... sure and secure wherever it has been Hyspliced! For every overhead conductor and for every size, there's a Burndy Hysplice sleeve. Regardless of the installation, there is a Burndy tool for the job—manual, hydraulic or electrically-driven. Each one most efficient for the job it was designed to do.



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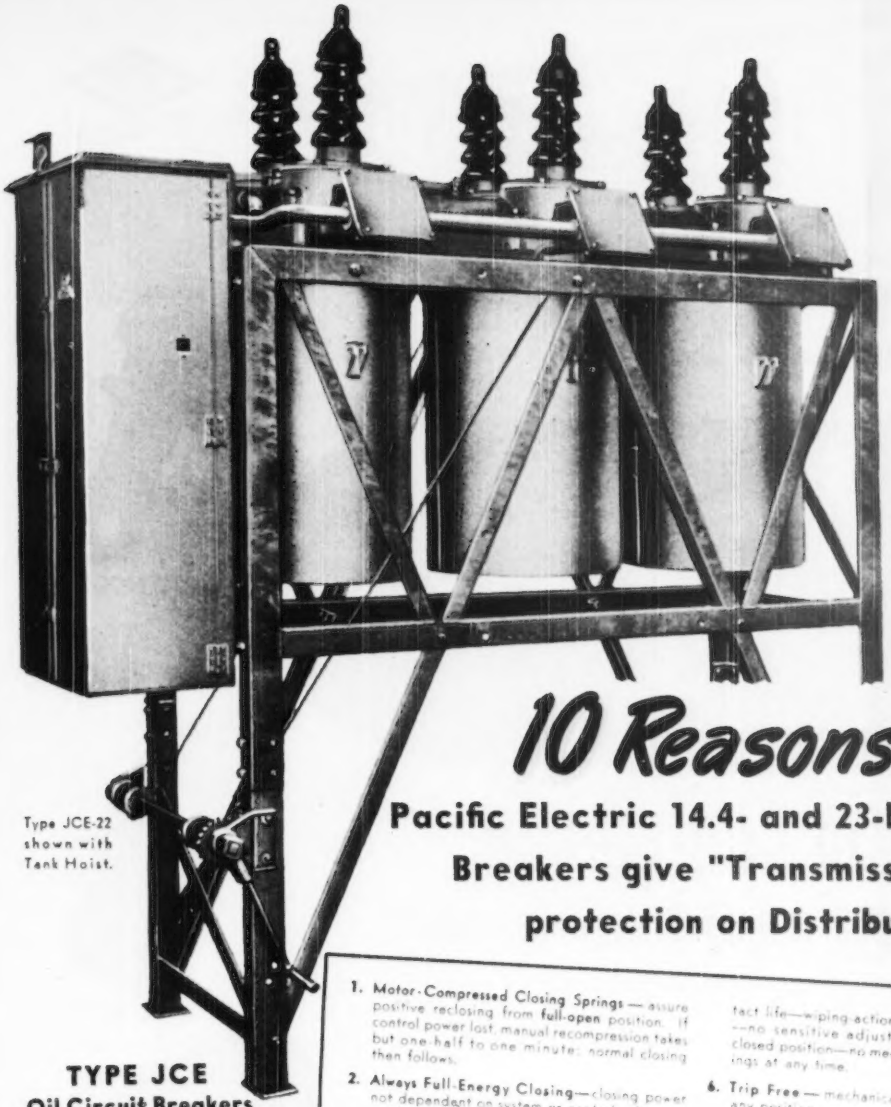
Want to know about Hysplices for Copper, ACSR and other conductors? How about performance. Why do Burndy Hytools and Hypresses simplify splicing? **20-page HYSPLICE CATALOG** gives you the answer. Write Burndy for your copy.



Type JCE-22 shown with Tank Hoist.

New Protective Performance for

- Feeders
- Distribution Lines
- Industrial Loads

10 Reasons Why

Pacific Electric 14.4- and 23-kv Circuit Breakers give "Transmission-type" protection on Distribution Lines

TYPE JCE
Oil Circuit Breakers

14.4 kv — 600 amp
100,000 int. kva;
600 and 1200 amp
250,000 int. kva;
23 kv — 600 amp
250,000 int. kva.

NEMA STANDARDS

1. **Motor-Compressed Closing Springs** — assure positive reclosing from **full-open** position. If control power lost, manual recompression takes but one-half to one minute; normal closing then follows.
2. **Always Full-Energy Closing**—closing power not dependent on system or control voltage—no slow opening or blow-back from sustained fault.
3. **Single-Unit Rotary Contact Structure**—moves as one piece—under no mechanical stress in either open or closed position—easy to inspect.
4. **Simple Interrupter**—a glance shows whether or not it is "in order."
5. **Sliding-Shoe Nested Contacts**—easy to inspect—separate surfaces for arcing and load currents—leaf springs apply nearly constant pressure so require no adjustment during contact life—wiping action insures clean contact—no sensitive adjustment required to fix closed position—no mechanical stress on bushings at any time.
6. **Trip Free** — mechanically and electrically, in any position.
7. **Control Current No Greater Than Trip Current** —even for high-speed reclosing, the control current is carried by small-sized wires.
8. **3-Shot Reclosing Timer** — mounted in operating mechanism cabinet—for all usual duties including cut-off of instantaneous attachment after first reclose, if specified.
9. **Full A-c if Desired**—rectifiers not required—anti-pump and series trip available with or without relays.
10. **Shipped Assembled**—tested and adjusted at the factory.

Get All Facts . . .

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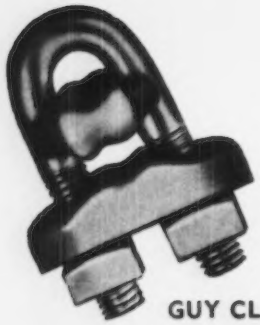
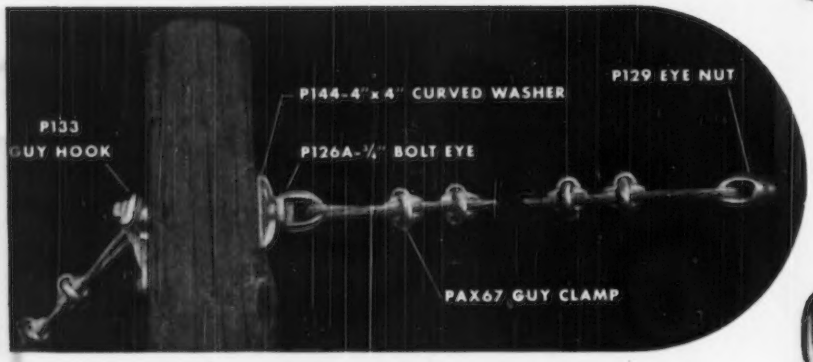


GUY CLAMPS

WASHERS

GUY HOOKS



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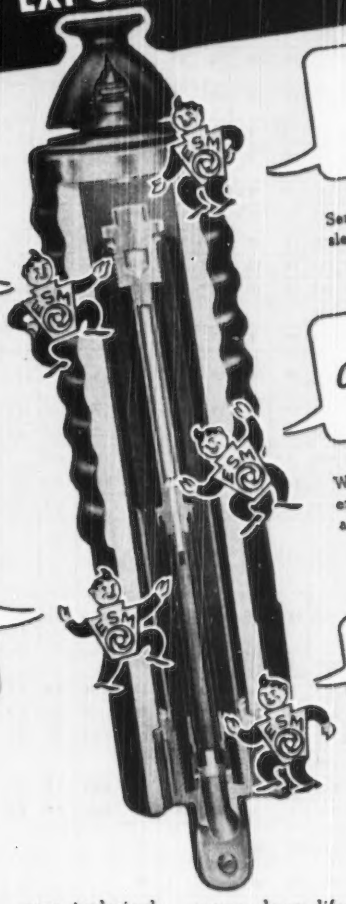
KEYSTONE EXPULSION ARRESTER



NO LINE LOCKOUTS

Series gap enclosed; unaffected by sleet, snow or weather.

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. . . can flow through fibre arc-quenching element; this eliminates possibility of burning or charring fibre parts.

HIGH SURGE CURRENT CARRYING CAPACITY

Withstands surge current far in excess of NEMA—standard 65,000 amp discharge test.

PARALLEL DISCHARGE PATHS ASSURE LONG LIFE

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. . . prevents complete chopping of voltage wave impressed across transformer insulation. Prolongs insulation life.

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The new Keystone expulsion type arrester provides low impulse sparkover and excellent transformer protection . . . high surge current carrying capacity . . . and its many new features assure long life of arresters and transformers.

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Which of these Dilecto Grades Can Meet Your Requirements?

ELECTRICAL AND MECHANICAL PROPERTIES OF DILECTO SHEET GRADES, APPROXIMATE AVERAGE VALUES

NEMA Grade	Continental-Diamond Grade (sheets) DILECTO	Lbs. cu. in.	Specific Gravity	Water Absorption, %, 24 hrs.	Rockwell Hardness "M"	Tensile Strength Thousands of psi LW	Tensile Strength Thousands of psi CW	Flexural Strength Thousands of psi LW	Flexural Strength Thousands of psi CW	Compression Strength Thousands psi (Flat)	Bonding Strength, lbs. (1)	(1) Impact Strength (Izod) Notched in ft. lbs. per 1" of Notch Flatwise LW	Flatwise CW	Edgewise LW	Edgewise CW	Dielectric Strength in Volts per Mil Short Time	Dielectric Strength in Volts per Mil Step by Step	(2) Power Factor 10^6 cycles /seconds As Recd.	(2) Power Factor 10^6 cycles /seconds Wet	(2) Dielectric Constant 10^6 cycles /seconds As Recd.	(2) Dielectric Constant 10^6 cycles /seconds Wet	(2) Loss Factor 10^6 cycles /seconds As Recd.	(2) Loss Factor 10^6 cycles /seconds Wet
X	X-13	.0497	1.38	2.0	110	15	12	30	22	42	1100	2.5	2.0	0.70	0.60	750	530	0.039		5.10		0.20	
P	XP-13	.0497	1.38	1.5	100	11	10	20	16	26	900			0.60	0.50	575	400	0.036	0.04	4.6	5.2	0.17	0.21
	XP-90	.0476	1.31	2.5	45	9.7	7.2	12	10	19				1.00	0.70	600	400	0.055		5.5		0.30	
XXP	XXP-13	.0497	1.38	0.9	110	10	8	17	14	27	1000			0.50	0.45	750	530	0.030	0.034	4.3	4.5	0.13	0.15
XXXP	XXXP-13	.0497	1.38	0.5	110	9	7.5	16	13	27	1100			0.40	0.35	700	500	0.026	0.028	4.2	4.4	0.11	0.12
	XXXP-22	.0466	1.29	0.3	115	12	10.5	13.5	12	27.5				0.379	0.338	810	675	0.024	0.027	4.08	4.2	0.10	0.115
	XXS	.0497	1.38	1.5	100	12	10	19	17	34	950	1.1	1.0	0.50	0.45	700	500	0.038	0.042	5.2	5.4	0.20	0.23
XX	XX-13	.0497	1.38	0.9	110	12	10	19	17	34	950	1.1	1.0	0.50	0.45	700	500	0.038	0.039	5.2	5.3	0.20	0.21
XXX	XXX-13	.0497	1.38	0.7	115	11	10	19	16	36	1200	0.9	0.85	0.45	0.40	650	470	0.034	0.035	4.8	4.9	0.16	0.17
	XXARC	.0497	1.38	3.0	100																		
	XXHV	.0497	1.38	1.3	110	10	8	17	15	27	950					600	450	0.033	0.039	4.7	4.8	0.16	0.19
	CBW	.0497	1.38	1.9	100	12	10	19	18														
A	A-13	.0614	1.70	0.8	100	10	7	18	16	38	900	1.9	1.8	0.9	0.8	200	120	0.115		5.2		0.60	
AA	AA-13	.0560	1.55	0.7	110	10	6.5	19	15	40	1800	5.0	4.1	4.5	4.0	75	45	0.44		6.8		2.99	
	MAA	.0639	1.77	5.3	108	7.4	6.5	13	12	45	1300	6.0		4.0		35	27	0.57		13.4		7.7	
	FA-72	.0578	1.60	0.7	115	21	17	38	27	48	1400	5.0	4.0	2.5	2.0	70	50						
	MA	.0650	1.80	1.2	115	10	6	17	13	40	900	1.3	1.1	0.85	0.75	150	80	0.11		8.2		0.90	
	CF	.0497	1.38	0.8	100	11.5	9.5	22	22	38.5				2.0	1.6	200	125						
C	C-413*	.0497	1.38	1.0	110	11	9	21	19	40	2000	3.6	3.5	2.4	2.1	200	120	0.065		6.0		0.36	
	MC	.0584	1.45	3.0	107	9.5	7.9	17	16.6	39				1.4		300	200	0.07	0.17	8.4	15.5	0.59	2.70
	CV	.0497	1.38	0.8	115	9	8	20	18	40	2200	2.4	2.3	1.5	1.4								
CE	CE-800	.0497	1.38	0.8	115	9	8	20	18	38	2200	2.4	2.3	1.5	1.4	380	265	0.050	0.058	5.2	5.6	0.26	0.33
L	L-400*	.0497	1.38	0.9	110	12	9.5	23	18	39	1900	3.3	3.0	1.4	1.3	200	120	0.065	0.072	6.0	6.3	0.39	0.45
	ML	.0584	1.45	2.0	110	13.5	9.1	22	15	39				0.7		325	230	0.07	0.20	8.4	8.95	0.59	1.79
LE	LE-13	.0497	1.38	0.7	115	10	8	21	17	40	2000	2.5	2.0	1.5	1.1	450	290	0.045	0.050	4.8	5.2	0.22	0.26
	LDC	.0497	1.38	0.6	115	9	7.3	20	16	40	2000	2.5	2.0	1.5	1.1								
	GB-115-M†	.061	1.69	3.0	114	22	20			45						600	400	0.018		7.0		0.126	
	GB-115-D†	.060	1.65	2.5	110	33	30			38						900	700	0.018		5.0		0.090	
G5	GB-125-M	.0686	1.90	2.2	110	25	22	40	38	50	1700	17.5	16.5	14.0	13.0	500	330	0.013		7.2		0.094	
G3	GB-125-D	.0578	1.60	0.6	95	24	15	21	19	44	1500	10.0	7.0	8.0	7.0	600	390	0.025	0.04	4.9	5.3	0.13	0.21
G1 & G2	GB-261-D	.0542	1.50	0.6	105	15	11	22	19	39	1200	9.0	5.5	8.0	5.0	425	360	0.011	0.02	4.2	4.3	0.046	0.086
	Diamond Dilecto	.0506	1.40	11.0	90	15	9	24	20	38	1000	7.0	5.5	1.5	1.4	600	390	0.055	0.080	6.0	6.5	0.33	0.52
	MEC-5	.0423	1.17	0.2	100	6.7	5.7	11	9.5	48	850	5.5	4.0	3.0	2.0	370	340	0.016		4.43		0.071	
	GB-112-S	.0614	1.70	.15		19		27		31	960			7.2	5.5	325	300	0.002	.013	3.9	4.6	0.008	0.060
	GB-122-S	.0614	1.70	.15		18		23		46	800			12	10	250		0.002		3.9		0.008	
	GB-261-S	.0614	1.70	.20		22		24			990			9.5	8.0	150		0.002		3.9		0.008	

NOTES: All tests, except "blistering temperature," were conducted in accordance with American Society for Testing Materials Methods for Sheet Electrical Insulation.

*These Grades approximate the physical properties of Celoron.

†These grades are made principally in the thicknesses from .010" to .025". The data shown is for .025" thick sheet.

(1) Flatwise impact test and bonding strength values are based on 1/2" thick material. All other tests are based on 1/8" thick material except the values for grade XXARC, which are based on 1/32" thickness.

(2) Wet power factor, dielectric constant, and loss factor values are based on samples which had been immersed in fresh water for 24 hours at 25° ± 2° C.

(3) Insulation Resistance values were determined on samples conditioned for 96 hours at 90% ± 2% relative humidity at 35° ± 1° C.

...Plus these other high strength C-D Plastics with *unusual combinations* of electrical, mechanical, and chemical characteristics:

Vulcanized Fibre **Vulcoid** **Celoron** **Micabond** **Spiral Tubing**

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STANDARD SIZES OF DILECTO SHEETS . . . TUBES . . . RODS

Blistering Temp. °C	Blistering Temp. °F	Arc Resistance in Seconds	Insulation Resistance, Megohms (3)	Deformation under Load in %	Colors (4) and Finish (5)	SHEETS		TUBES						MOLDED RODS Lengths Approx. 38" to 40"	Continental-Diamond Grade (sheets) DILECTO
								MOLDED Lengths Approx. 18" to 144" (8)			ROLLED Lengths Approx. 18" to 96"				
						Thickness in Inches Inclusive	Approximate Size in Inches	Min. (7) Wall Thickness, Inches	I.D. in Inches Inclusive	O.D. in Inches Inclusive	Min. (7) Wall Thickness, Inches	I.D. in Inches Inclusive	O.D. in Inches Inclusive	Diameter in Inches Inclusive	
220	428	10	90		Black, Natural, Nat. core with Black surfaces	.010—2	36 x 42 38 x 38 38 x 43 38 x 96 39 x 46 46 x 70 except thicknesses under 1/32" made only in 38 x 38 and 38 x 43 sizes XXARC-38 x 38 and 38 x 43 only	1/16	1/8—9	1/4—9-1/2	1/32 (6)	1/8—48	3/16—50	not made	X-13
240	464	10	100		Black, Natural, Nat. core with Choc. surfaces	.010—1/4		not made			not made			not made	XP-13
240	464	7	35		Natural	.010—1/4		not made			not made			not made	XP-90
220	428		500		Blk., Nat. Choc., Nat. core with Brown surfaces	1/64—1/4		not made			not made			not made	XXP-13
220	428	4	2000		Black, Natural	1/64—1/4		not made			not made			not made	XXXP-13
240	464	9	9400		Natural	1/64—1/4		not made			not made			not made	XXXP-22
250	482	4			Black only	1/32—2		not made			not made			not made	XXS
250	482	4	500	0.77	Black, Natural	.010—2		1/16	1/8—9	1/4—9-1/2	1/32 (6)	1/8—48	3/16—50	1/8—2 (9)	XX-13
240	464	4	800	0.65		1/64—2		1/16	1/8—9	1/4—9-1/2	1/32 (6)	1/8—48	3/16—50	1/8—2 (9)	XXX-13
		10	159		Olive Green	1/64—1/4		not made			not made			not made	XXARC
		10	100		Black, Natural	1/64—2		not made			not made			not made	XXHV
					White core, Blk. surfaces; alternating Blk. and White layer or Blk. surfaces	1/32—1/4	38 x 38	not made			not made			not made	CBW
220	428	4			Natural	.025—2	38 x 38 and 38 x 43 except Grade A 36 x 38 36 x 43	1/16	3/16—9	5/16—9-1/2	1/16	3/16—48	5/16—50	1/4 to 2 (10)	A-13
270+	518+	4				1/16—2		1/8	3/8—9	5/8—9-1/2	1/8	1—48	1-1/4—50	1/2 to 2	AA-13
300+	572+	75	.25	.90	Grey	1/16—2		1/8	3/8—9	5/8—9-1/2	1/8	1—48	1/4—50	1/2—2	MAA
		4			Natural	.025—2		1/16	3/16—9	5/16—9-1/2	1/16	3/16—48	5/16—50	1/4 to 2 (9)	FA-72
230	446	80	5		Grey	.025—2	36 x 36	1/16	3/16—9	5/16—9-1/2	1/16	3/16—48	5/16—48	1/4 to 2 (9) (10)	MA
200	392	4	10	1.3	Natural	1/32—3/8	38 x 38 38 x 43 39 x 46 39 x 70 46 x 70	not made			not made			not made	CF
230	446	4	25	1.3		.025—10	38 x 38 38 x 43 39 x 46 39 x 70	1/16	1/4—9	3/8—9-1/2	1/16	3/8—48	1/2—50	1/4 to 4	C-813*
215	419	80	1.4	1.7	Grey	.025—2	38 x 43	1/16	1/4—9	3/8—9-1/2	1/16	3/8—48	1/2—50	1/4 to 4	MC
240	464	4			Black, Natural, except CV—Natural only	1/32—2	36 x 42 38 x 38 38 x 43 38 x 96 39 x 46	not made			not made			not made	CV
240	464	4	100	0.90		1/32—2		1/16	1/4—9	3/8—9-1/2	1/16	3/8—48	1/2—50	1/4—4	CE-800
220	428	4	25	1.3		.010—2		1/32	1/8—9	3/16—9-1/2	1/32	3/16—48	1/4—50	3/16—4	L-400*
		95	9.7	1.4	Grey	.015—2									ML
	446	4	100		Black, Natural	.015—2	38 x 38 38 x 43	1/32	1/8—9	3/16—9-1/2	1/32	3/16—48	1/4—50	3/16—4	LE-13
230	446	4			Natural	.015—2		1/32	1/8—9	3/16—9-1/2				3/16—4	LDC
270+		185	50	0.90	Brown	.010—.025	38 x 38 38 x 43								GB-112-M1
270+		4	20	0.50	Natural	.010—025	38 x 38 38 x 43								GB-112-D1
270+	518+	185	50		Brown	.015—2	38 x 38 and 38 x 43	1/16	1/4—9	3/8—9-1/2	1/16	1/2—48	5/8—50	1/2 to 2 (10)	GB-128-M
270+	518+	4	25	0.30	Natural	.025—2		1/16	1/4—9	3/8—9-1/2	1/16	3/8—9	1/2—11	1/4 to 2	GB-128-D
270+	518+	4	500	0.58		1/32—2		1/8	3/8—9	5/8—9-1/2	not made			1/2 to 2 (10)	GB-261-D
250+	482+	100	10		Grey	1/32—2	39 x 46	1/16	1/2—9	5/8—9-1/2	1/16	1—48	1-1/8—50	not made	Diamond Blacks
		7	10000	1.13	Natural	.010—1	38 x 38 38 x 43	1/32	1/8—4	3/16—5	not made			3/16—2	MEC-5
300+	572+	275	3000		Natural	.010—1/2	36 x 36 36 x 42								GB-112-S
300+	572+	275	800		Natural	1/32—1/2	36 x 36 36 x 42								GB-128-S
300+	572+	275	5.7		Natural	1/16—1/2	36 x 36 36 x 42								GB-261-S

(4) Natural Color varies from golden yellow to dark brown.
(5) Standard finishes are dull, semi-gloss or polished.
(6) The above specifications cover standard sizes regularly in production. Where your design requirements dictate, and our production facilities permit, other sizes can usually be made on special order.
(7) Maximum wall thickness is determined by inside diameter. Correspondence is invited on sizes where wall thickness is abnormally great.
(8) Lengths over 40 inches are available in a limited range of sizes.
(9) Diameters of 1" and over may have annular cracks.
(10) 36" lengths.

DE-5-50

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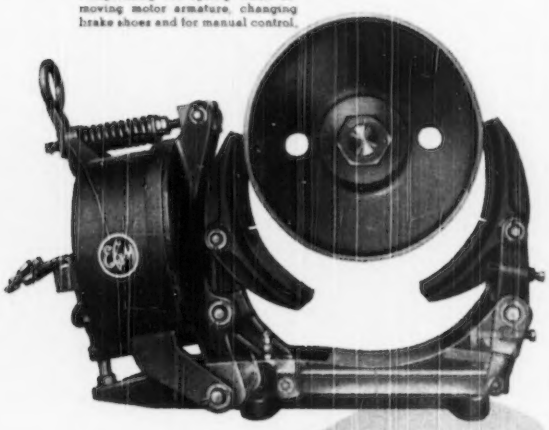
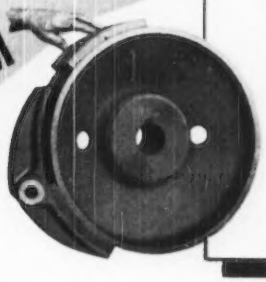
Type WB Brake showing how the motor armature is easily lifted out. At top left is the handle-nut for compressing the spring when removing motor armature, changing brake shoes and for manual control.



Long Life Brakes for A-C and D-C Motors by EC&M

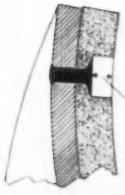


The brake lining is molded to match curvature of wheel and shoe.

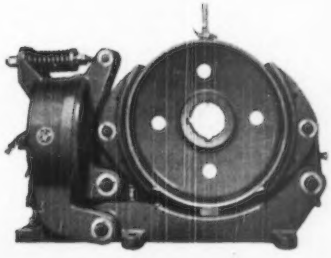
These Type WB Brakes for a.c. and d.c. service have a block type lining which is both thick and tough.

Furthermore, due to the process of manufacture, the blocks have proper frictional quality *throughout the entire thickness* permitting uniform and complete wear down to rivet heads. And since the material is non-compressionable, brake adjustments are infrequent.

EC&M Type WB Brakes are built in several sizes. They can be supplied with series or shunt-wound operating coils for direct current motors. On alternating current service, they are supplied in shunt-wound form for use with a compact rectifier - unit. Send for Bulletins 1004 and 1006 describing these long life brakes.

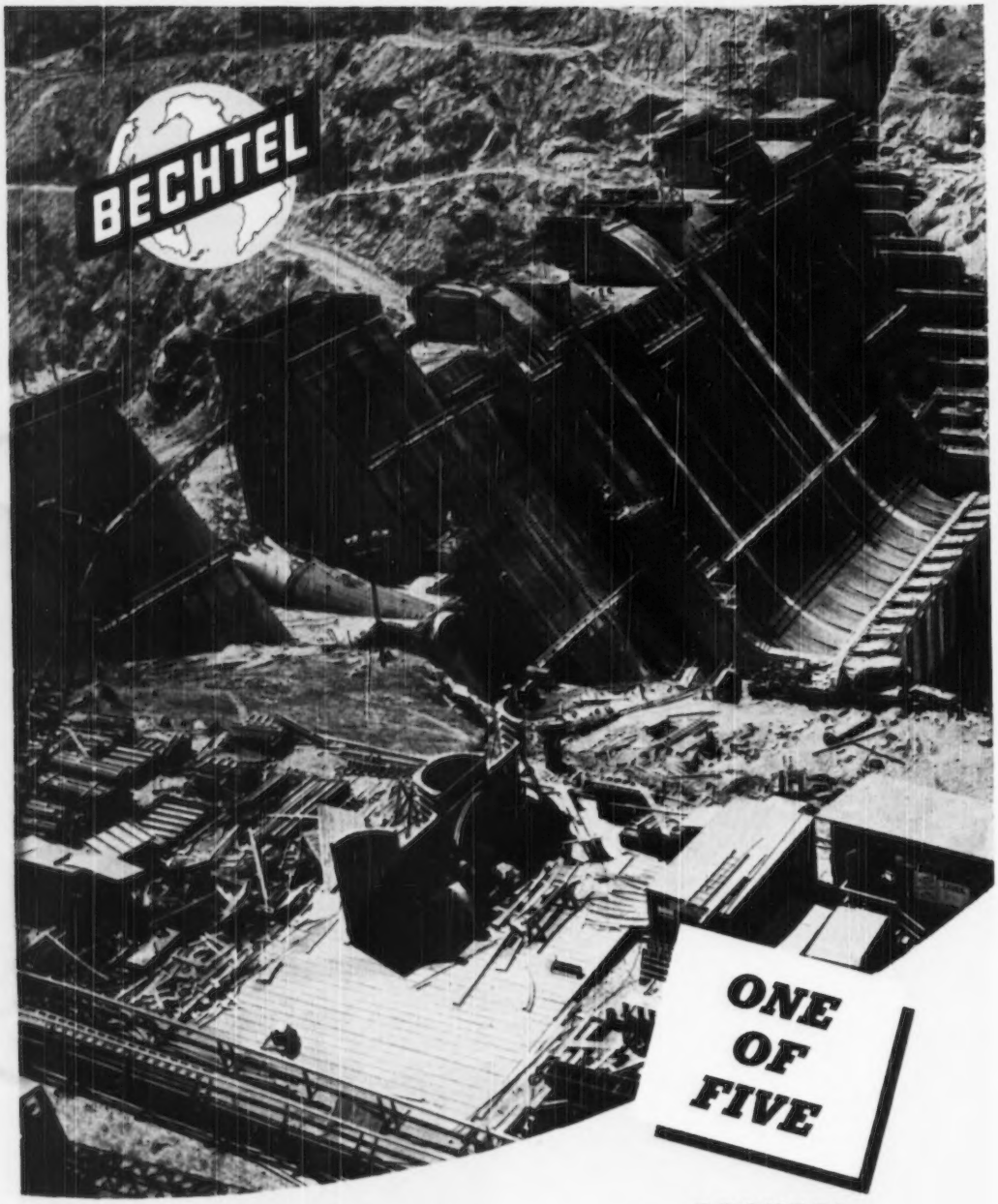


Actual wearing thickness, between rivet heads and brake wheel, is $\frac{1}{16}$" on the smallest size to $\frac{1}{8}$" on the largest size.



The BIG No. 60 Type WB Brake. The standard claw-hammer resting on the brake wheel gives a comparison of size.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO



Five giant power plants—***steam as well as hydro-electric***—are on our list of public utility projects now building or recently completed. The knowledge and organized resources shown at work here are ready to serve you wherever needed.

BECHTEL CORPORATION

Los Angeles • **SAN FRANCISCO** • *New York*
Tulsa

"BUILDERS FOR INDUSTRY"

DESIGN • ENGINEERING • CONSTRUCTION

meet the newest member of our

CONDUIT FAMILY

A new electrical raceway has been added to the famous Central Rigid Steel Conduit line . . . CENTRAL EMT. This new Spang product is a light-weight and easy-bending electrical raceway. It has an electro-galvanized finish on the outside and black enamel on the inside. CENTRAL EMT meets the Underwriters' Laboratories requirements and is approved by the National Electrical Code.

Friendly Central Conduit Distributors everywhere handle CENTRAL EMT. And they also handle CENTRAL LACO "HOT DIPPED", CENTRAL WHITE and CENTRAL BLACK to provide you with just the right conduit for any electrical raceway installation. What's more you'll find that Central Conduit Distributors are a dependable source of supply for many other electrical supplies.

SPANG-CHALFANT

Division of The National Supply Company

GENERAL SALES OFFICE: Grant Bldg., Pittsburgh, Pa.

District Offices and Sales Representatives in Principal Cities

CENLACO a hot dipped galvanized and lacquered finish, inside and out.

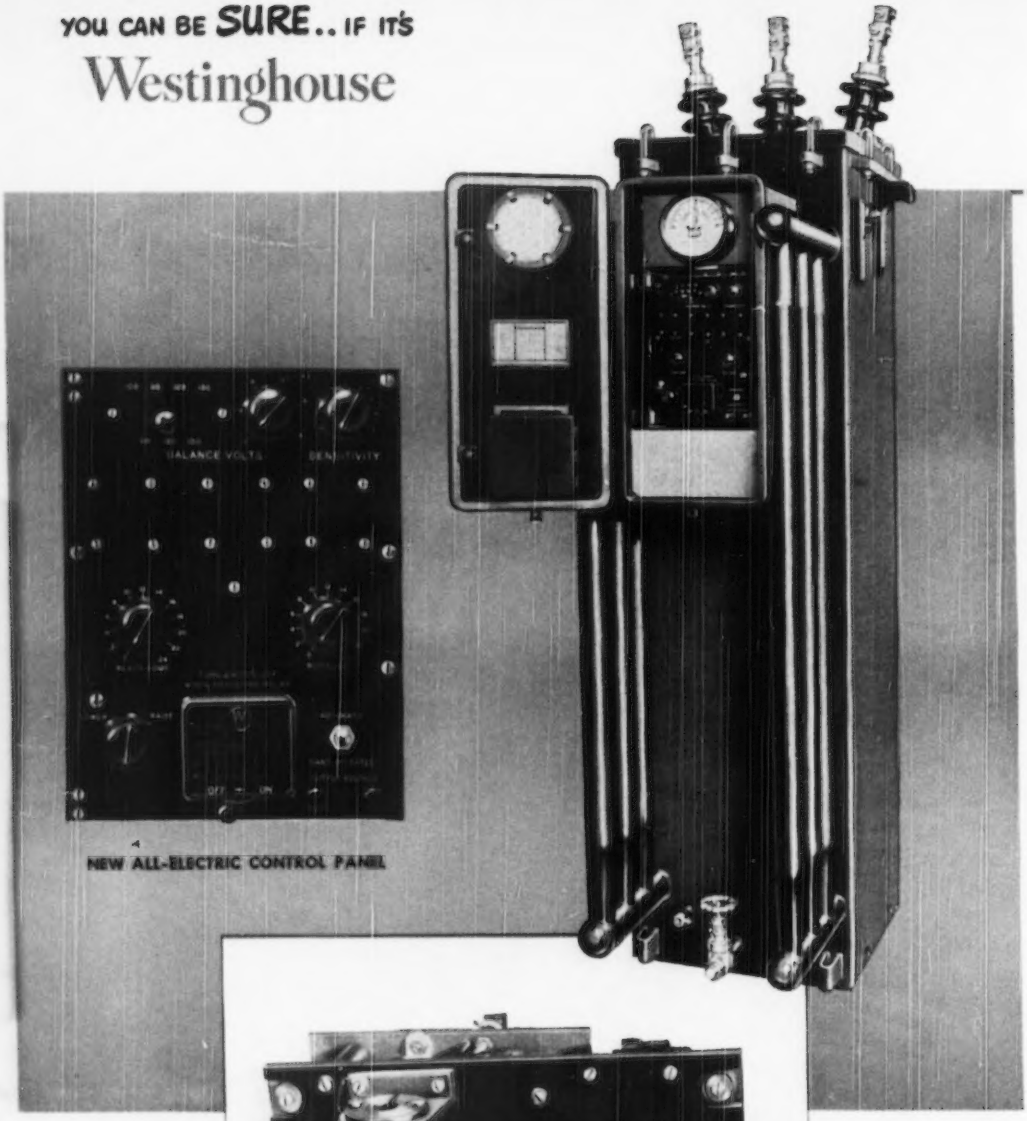
CENTRAL WHITE electro-galvanized outside and black enameled inside.

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

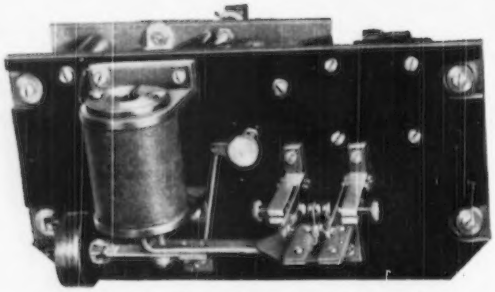
EMT—Light-weight electro-galvanized outside and black enameled inside.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



NEW ALL-ELECTRIC CONTROL PANEL



The new voltage regulating relay
. . . moving element spring-mounted.

More Dependable Regulation

without MECHANICAL ADJUSTMENTS

Easier to operate! Greater freedom from maintenance problems!

The new Westinghouse Induction Regulators give even more dependable regulation, with an all-electric control that eliminates mechanical adjustments.

All-electric control . . . easy to adjust:

Balance voltage and band width are determined by position of calibrated knobs and tap plug. That's all there is to it. Adjustments may be made without disturbing the line-drop compensator; either setting may be changed without interrupting service.

Rugged spring mounting eliminates delicate bearings:

Here's a nuisance maintenance problem licked! No more risk of trouble from mechanical bearings.

Spring-mounted . . . snap-action elements:

Motor operating relay has all moving parts spring-mounted, arranged to eliminate all armature impact . . . assures long life.

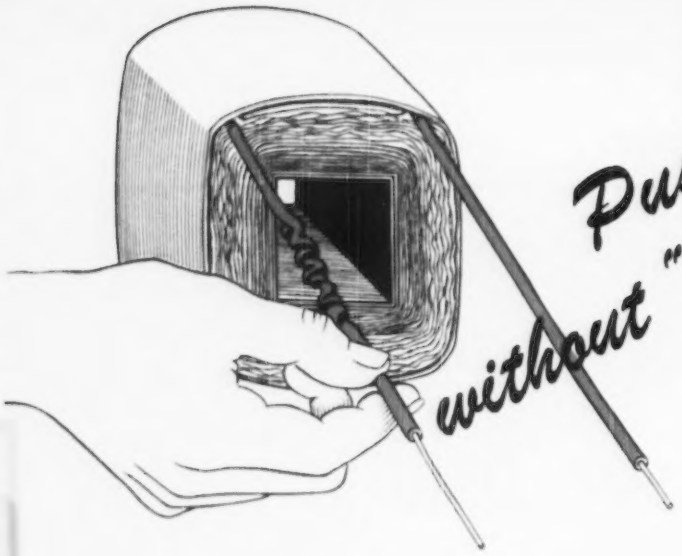
"Lifetime" contacts:

Another maintenance headache cured! Heavy silver contacts are designed to last the life of the unit.

Available in three models to meet all urban station requirements. Type SU, oil cooled. Type SA, air cooled. Type SI, Inerteen (R) cooled. For further information, ask your Westinghouse representative for a copy of B-4736, *Westinghouse Voltage Regulators for Urban Substations,* or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-10351

Westinghouse

VOLTAGE REGULATORS for ANY system



Push-back without "Breakdown"

New Tough Insulation Speeds Coil Production

In coil manufacture, the amazing flexibility of BH "649" Fiberglas Tubing and Sleeving permits ease of push-back with no loss of physical or dielectric properties. Saves valuable production time. Cuts down rejects. BH "649" can be twisted, compressed, folded —with no cracking or rupture of the film.

BH "649" has a smooth bore, handles easily during production with no snagging. Will not support combustion. Resists moisture, oils, grease or ordinary chemicals. Remains supple after baking at 302°F. for 24 hours. Unaffected at temperatures as low as —67°F. Suitable for use with most impregnants—for complete test data, see our Technical Data Folder. BH "649" is made in Grades A-1, B-1, C-1 and C-2—in all sizes from No. 24 to $\frac{5}{8}$" inclusive. Write for production samples.

BENTLEY, HARRIS MANUFACTURING COMPANY
CONSHOHOCKEN, PA.

BH *Fiberglas** SLEEVINGS

USE COUPON NOW

Bentley, Harris Mfg. Co., Dept. W-42, Conshohocken, Pa.

I am interested in BH "649" Fiberglas Tubing and Sleeving. Send samples for production testing of Grade_____ in sizes as follows_____ for _____ operating at temperatures of_____ °F. at_____ volts.
(size or I.D.) (product)

NAME_____

ADDRESS_____

Send samples, pamphlets and prices on other BH Products as follows:

☐ BH non-fraying Fiberglas Sleeving

☐ Cotton or Rayon-base Sleeving and Tubing

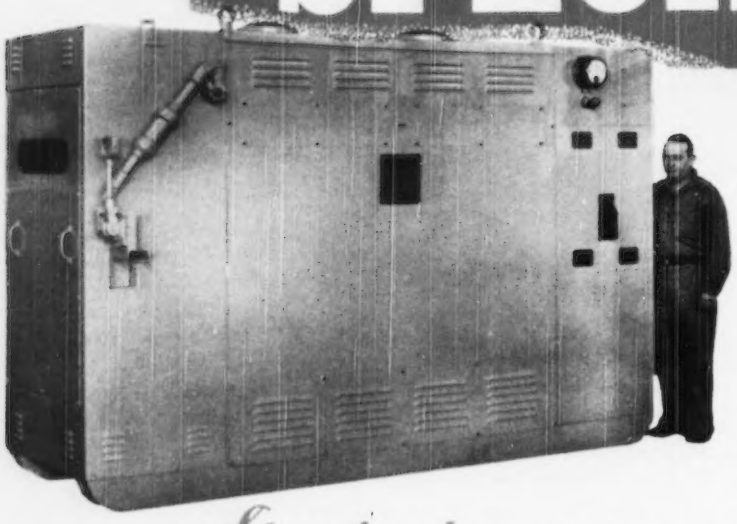
IF YOU HAD TO STACK 'EM ALL IN YOUR OFFICE...

Do you think that your system is one which "doesn't have trouble with high-voltage pin-type insulators?" If so, it might be worth a good many thousands of dollars per year to your company to have you take a real good look at your maintenance records. The number of pin-type insulators which have to be replaced every year—and the man-hours required to replace them—add up to an annual bill probably a great deal larger than you suspect. And it's a bill that could be cut to a tiny fraction of its present size by standardizing on Lapp Line Posts. There's a 19-year service record back of Lapp Line Posts to back up this fact. Isn't it time for *your* company to undertake the high-preformance low-cost Line Post program?

Lapp

LAPP INSULATOR COMPANY INC., LEROY, NEW YORK

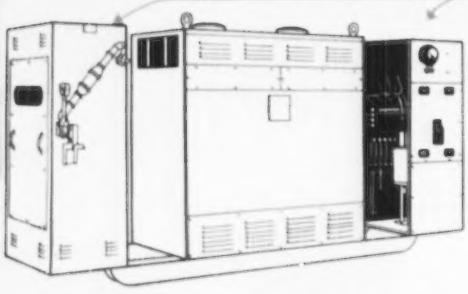
SPECIFY



Indoor unit substation including: High-voltage Disconnect Switch and Fuses, Air Cooled 1000 KVA STANDARD Transformer and Low-Voltage Circuit Breaker Cubicle with Metering. H-beam base permits portability. Suitable for platform mounting indoors.

WITH *Standard* BUILT UNIT SUBSTATIONS

YOU'RE FREE, IF YOU WISH, TO SPECIFY THE MAKE AND TYPE OF SWITCHGEAR YOU PREFER



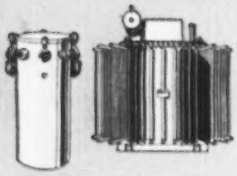
STANDARD builds transformers only . . . the heart of the load center. You have complete freedom in your choice of accessory equipment.

You specify the type and make of Switchgear and Cubicles which you prefer, and Standard will quickly produce a well-integrated unit — exactly designed to the proper dimensions and arranged according to your requirements.

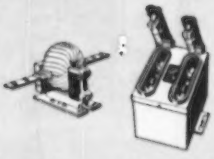
Standard assemblies provide maximum economy, combining lowest installation costs with the safest practices in the field of transformer application.

Special requirements are produced as quickly as standard jobs.

TRANSFORMERS FOR EVERY APPLICATION

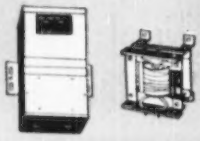


Liquid filled (sizes up to 10,000 KVA and 72 KV inc.)



Instrument transformers (for use on circuits up to 72,000 volts, inc.)

Dry type (up to 1000 KVA and max. voltage ratings of 4800)

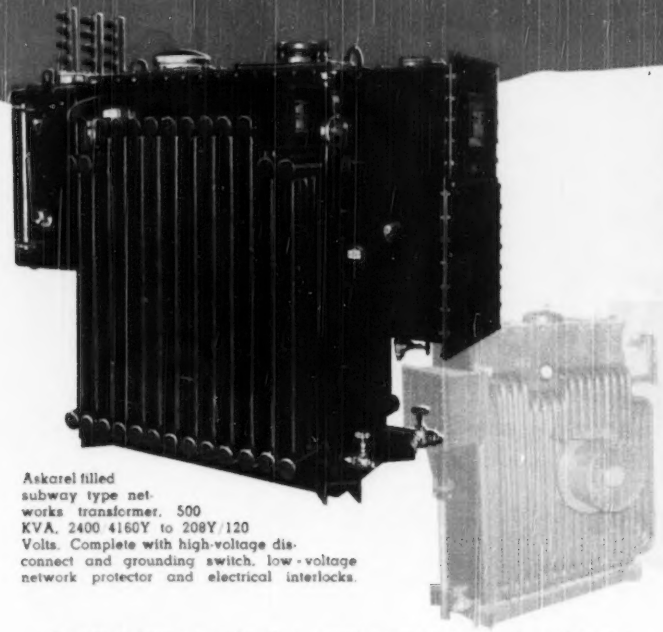


Control transformers (compound filled or open type)

Standard
TRADE MARK ®

· LOAD CENTERS · UNIT SUBSTATIONS

AIR, OIL OR ASKAREL COOLED



Askarel filled subway type networks transformer, 500 KVA, 2400-4160Y to 208Y/120 Volts. Complete with high-voltage disconnect and grounding switch, low-voltage network protector and electrical interlocks.

Load center unit substation, 300 KVA Askarel filled transformer, equipped with high-voltage disconnect switch, pothead, key interlock and low-voltage cubicle containing secondary circuit breakers. Suitable for either indoor or outdoor installation.

Standard has specialized in transformer design and application for more than 30 years.

Every load center substation is custom-built to fit a specific need.

Whether unit substations are required for indoor, outdoor or underground installation, STANDARD can meet your most exacting requirements and include accessory equipment made by your preferred supplier. Write today for specific information.

SEE YOUR NEARBY Standard REPRESENTATIVE FOR ALL YOUR TRANSFORMER NEEDS

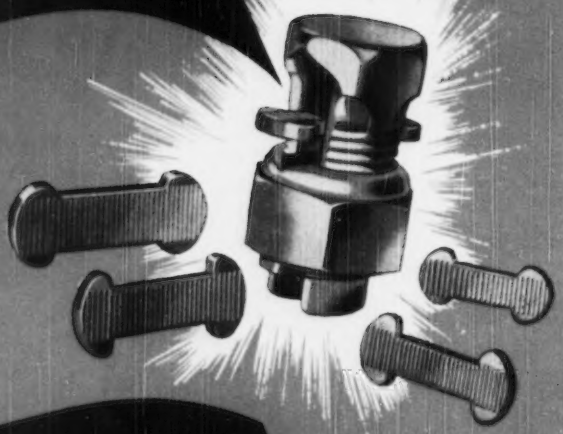
THE STANDARD TRANSFORMER COMPANY

WARREN, OHIO • REPRESENTATIVES IN PRINCIPAL CITIES

Dead-end Wires the Modern Way—

Use KEARNEY CON-NEC-TITES With Spacers

The trend toward the use of connectors for dead-ending wires has been accelerated by the introduction of the serrated spacer-washer. Because this washer adds approximately 60% to the holding power of a Con-Nec-Tite, dead ends can now be accomplished with the use of only one Con-Nec-Tite with spacer, where formerly two and three were used.



Here's the NEW KEARNEY PRESSURITE CLAMP

FOR PERMANENT HIGH PRESSURE TAPS

The casting of this compact, two-bolt design is made of high-strength bronze alloy with bolts of silicon bronze. It is available for use with copper or aluminum conductors from 1/0 to 1000 MCM and can accommodate two maximum size cables, or one maximum size and any smaller size to a minimum of No. 8 A.W.G. solid. Shakeproof washers prevent loosening under vibration.

Complete data is available — just write for Bulletin No. 12-12.

JAMES R. KEARNEY CORPORATION
4224-42 Clayton Avenue, St. Louis 10, Missouri

BETTER CONSTRUCTION *Safer* MAINTENANCE

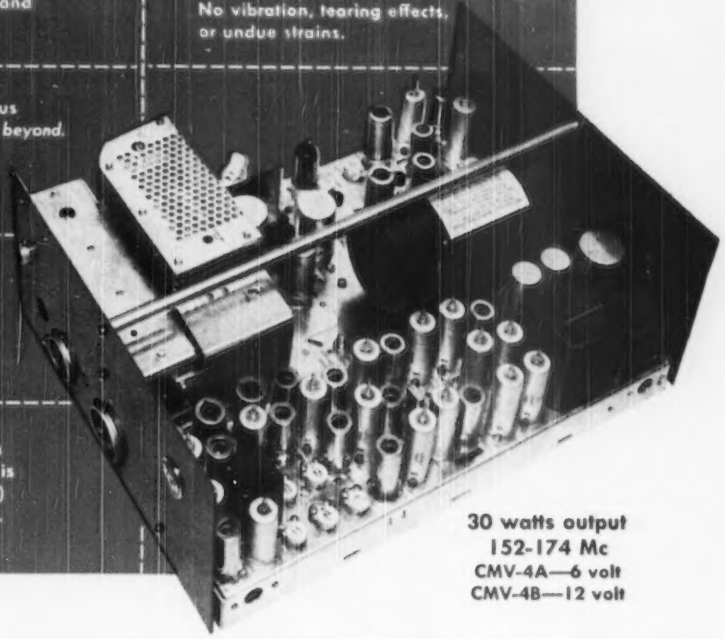
Unique grounded-grid r-f input circuit provides high receiver sensitivity, greater frequency stability, and simplified tuning.

Heavy-duty dynamotor equipped with cooling fins. Mounted near chassis center of gravity. Excellent balancing. No vibration, tearing effects, or undue strains.

Built-in filter reduces spurious emission to 1000 Mc. —*and beyond.* All spurious emissions and harmonics in the band down at least 85 db.

Convenient pin jacks provide easily accessible points for servicing and tuning.

Frequency stability is within 0.001% (without an oven); is within 0.0005% (with oven) between −22° and +140° F.



30 watts output
152-174 Mc
CMV-4A—6 volt
CMV-4B—12 volt

NOW *the 30-watt SUPER Carfone*

A revolutionary new 2-way radio for police, fire fighting, public utilities, taxis, pipelines, and construction services

- ☑ Clear reception assured *within a few feet* of adjacent-channel stations because of superior circuit design.
- ☑ Message intelligibility improved by raising average modulation to 70% (ordinary transmitters give 10 to 35%).
- ☑ Spurious emissions at any frequency down at least 85 db (20 times better than required by FCC). Meets all RMA requirements.
- ☑ Economical to operate (low current drain on stand-by; high-efficiency amplifier takes less power). Tubes are operated for optimum life; at least half of them idle at 1/5 of maximum rating.
- ☑ Excellent performance in crowded metropolitan areas, as well as farther out in the suburbs where the going is tough.
- ☑ Cuts down interference *within the band* at least 100 db (100 times better than required by FCC regulation).
- ☑ Balanced construction reduces vibration—extends equipment life.

The Super Carfone 30 package—(1) single-unit transmitter, receiver, and power supply; (2) control box; (3) microphone and antenna.

RCA

MOBILE COMMUNICATIONS SECTION
RADIO CORPORATION of AMERICA
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

A Brand New Plant

to make Reynolds ACSR

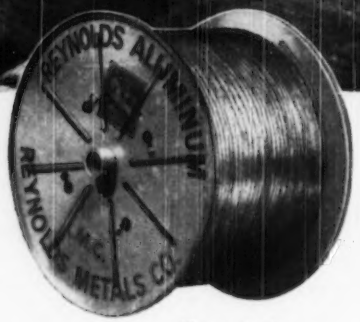
THIS HUGE NEW $3,000,000 plant at Listerhill, Alabama, turns out just one thing—Reynolds ACSR with all its advantages!

ACSR is better because it provides high conductivity at low cost; it has great strength, is easier and faster to string, requires fewer poles and accessories. And now it comes in a new Reynolds-developed package—the Master Coil* that eliminates wooden reels. A new Master Reel* assembles around the Master Coil *on the job*—does away with reel collection and return, and tie-up of your money for deposits. No storage problems—only a few Master Reels are needed on the largest projects.

Better investigate these better ways. Call the Reynolds Field Office listed under "Aluminum" in classified phone directories. Or one of the distributors listed below.

Reynolds ACSR is distributed by

Westinghouse Electric Supply Co., New York, N. Y. (And branches) • North Coast Electric Co., Seattle, Washington • Griffin Manufacturing Co., Dallas, Texas • Southern Electric Supply Co., Houston, Texas • Williamson Sales Co., Shreveport, Louisiana (And branches) California Electric Supply Corp., San Francisco, California



*Pat. applied for

ACSR MANUAL FOR ENGINEERS

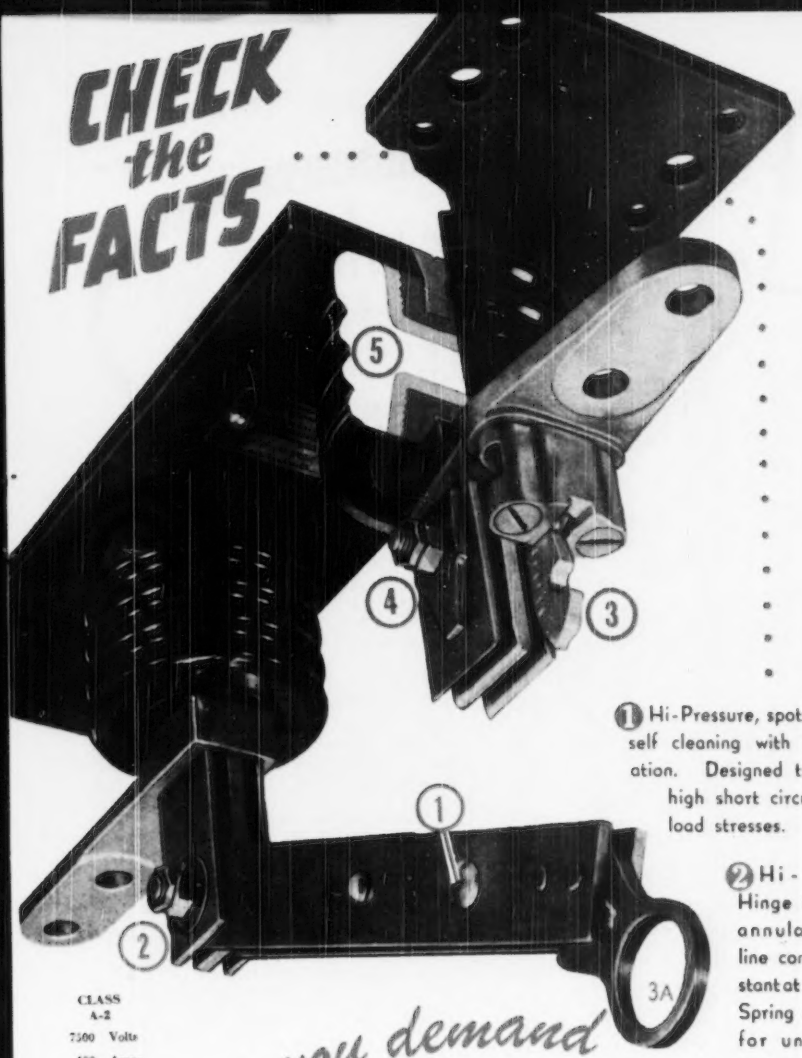
Contains sag-tension charts, staking and stringing-sag tables, data on line design and erection, etc. Free when requested on business letterhead—write to Reynolds Metals Company, Louisville 1, Kentucky.

REYNOLDS METALS

REYNOLDS *Lifetime* ALUMINUM

CONSIDER ALUMINUM • CONSULT REYNOLDS • THE COMPLETE ALUMINUM SERVICE

CHECK the FACTS



CLASS
A-2
7500 Volts
600 Amps.

1. Hi-Pressure, spot contacts — self cleaning with each operation. Designed to withstand high short circuit or overload stresses.

2. Hi-Pressure Hinge Contacts — annular, uniform line contact is constant at all positions. Spring cup washers for uniform ring contact loading.

3. Positive safety Latch — controlled by easy operating latch handle (3A), which has blade starting pry-out.

4. Contact Pressure Spring of Phospher Bronze — provides uniform spot contact loading.

5. Insulator bonded to hardware with resilient metal which provides for mechanical shock — jig set for accurate alignment.

Because you demand switch **RELIABILITY..**

R&IE

RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.
AFFILIATED WITH THE I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA
IN CANADA – EASTERN POWER DEVICES LIMITED, TORONTO

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES
INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

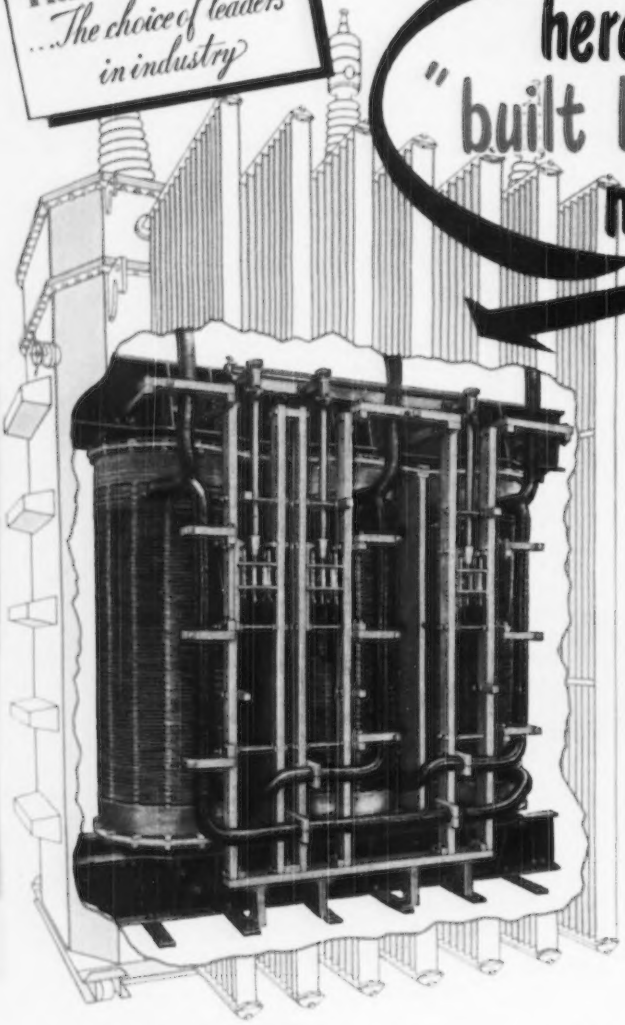
AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

WAGNER TRANSFORMERS
...The choice of leaders in industry

here's what "built by Wagner" means



Wagner Power Transformers have a reputation for Quality—established through sixty years of service to the power industry. Constant improvements in materials and shop practices—meticulous attention to even the smallest details of construction—rigid maintenance of quality controls—have made Wagner Power Transformers "the choice of leaders in industry." Wagner Transformers give years of uninterrupted service because of features like these:

The coils, wound with cable paper insulated conductor, are carefully insulated from each other, and are surrounded by liberal oil ducts. Coils adjacent to the line ends have extra turn insulation and additional coil-to-coil insulation to absorb the impact of high voltage line disturbances. Coil stack assemblies have locked-in insulating spacers placed radially around the coils to maintain the oil ducts. The coil stacks are vacuum-dried, then securely fastened between heavy steel end clamps and the endplate assembly, bracing the structure to withstand short circuit conditions. All outgoing leads are heavily insulated to prevent any possibility of breakdown. All leads are mechanically held in place to maintain proper electrical clearance at all times and under all conditions of operation. Snap-acting tap changers are gang operated from outside the transformer tank by means of a shaft brought out through the tank wall.

The complete story of Wagner Power Transformer construction is told in Bulletin TU-181. Write for your copy.

Wagner maintains thirty-one branch offices, located in principal cities, for quick, convenient engineering service and consultation. Consult the nearest branch for competent advice on your next transformer installation.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

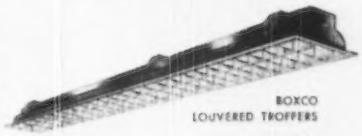
WHY TROFFERS? WHY DAY-BRITE?

There's this to say about troffer lighting: *good taste and good light!* The smart, modern appearance of recessed troffers . . . the smooth, unbroken surface of the ceiling . . . the endless variety of lighting patterns . . . all contribute an atmosphere of elegance and discrimination.

And when interiors deserve top-quality troffer lighting, there's no equal for Day-Brite troffers . . . in appearance, in quality, in true economy. Day-Brite quality is especially important, for troffer installations are permanent . . . *you must be sure of long-term, trouble-free performance before you buy!*

Six basic groups to choose from . . . each available in 96" Slimline and 48" Standard Fluorescent . . . each available in snap-in and flange types . . . each adaptable for countless geometric patterns or for unit or continuous installations. Fine lighting equipment? Yes . . . and fine lighting *value:* value that *only* famous Day-Brite quality can produce.

A COMPLETE TROFFER LINE



BOXCO LOUVERED TROFFERS

HOLOPHANE CONTROLENS* TROFFERS

HOLOPHANE CURVED CONTROLENS* TROFFERS

GLASS ENCLOSED TROFFERS

LATERAL LOUVERED DEEP TROFFERS

PARABOLIC TROFFERS

ACCENT UNITS— FIXED AND ADJUSTABLE

*® HOLOPHANE CO.

DISTRIBUTED NATIONALLY BY LEADING ELECTRICAL WHOLESALERS

Day-Brite Lighting, Inc., 5425 Bulwer Ave., St. Louis 7, Mo.

In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario

034

ONLY QUALITY IS ECONOMICAL

"DECIDEDLY BETTER"

DAY-BRITE

Lighting Fixtures

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

IT TAKES A BALL AND TWO JEWELS

FOR *Lowest Meter Maintenance**

They are the time-proven combination of special alloys and jewels . . . resulting in a meter bearing with the lowest friction and longest life. Your own records have proved it!

You *completely* forget lubrication and periodic bearing replacement. Mechanical adjustments are eliminated. Precision construction insures centering of the disc in the air gap.

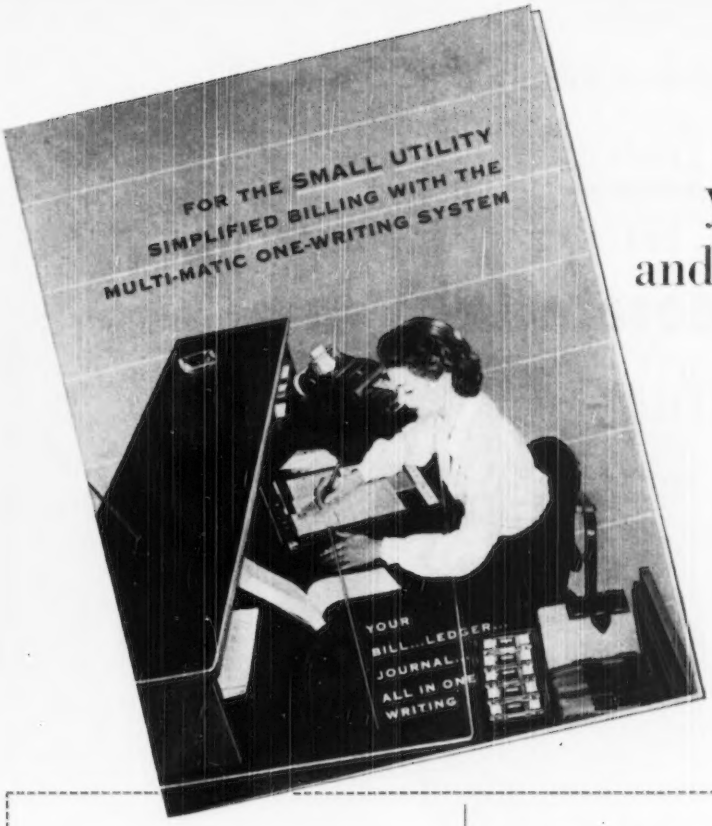
This proven combination saves money every year the meter is in service. No other meter bearing is so dependable . . . so free from friction and wear. Even under extreme overload, the normal action of the bearing and moving element is unimpaired.

You'll find this reputation for low-cost metering proved by your own records and by the records of other power companies. Get *all* the facts. Call your nearest Westinghouse office or write for the new booklet "What It Takes for Long-time, Low-cost Metering", B-4665. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-40369

Westinghouse METERS

*A VITAL PART OF LONG-TIME, LOW-COST METERING



If you do your billing and accounting by hand...

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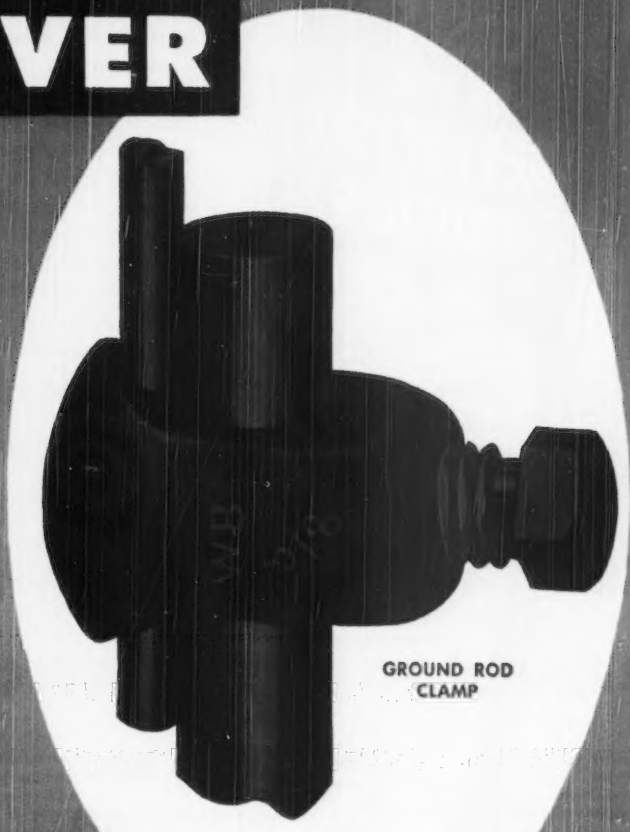

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THE STRANGE CASES OF THE INEFFECTIVE BRUSHES

...or 3 who-dun-its in 1

Often a new brush grade is the answer to brush problems. In many other cases it isn't. Careful examination of factors directly related to brush performance frequently reveals defects which, because they cause brush troubles, are blamed on the brushes themselves.

Included here are three typical case histories. As the world's largest producer of small motor brushes, Stackpole offers a wealth of practical experience both in supplying suitable brush grades and in applying them for best results. One service is rendered as willingly as another. Stackpole brushes are sold direct to manufacturers of original rotating equipment.

1. The Coal Drill Motor Case

Brush life on a coal drill motor was far less than it should have been. But no change in brush grade was indicated by the Stackpole serviceman's investigation. All that was required was suitable compensation and re-setting of the brushes as far as neutral was concerned.

2. The ac-dc inverter case

Brush trouble on the input side of an ac-dc inverter proved a puzzler—until a Stackpole brush engineer was called on the job. He quickly found that the troublesome brush was simply being improperly fed by its phosphor bronze spring. Equipped with piano wire steel springs, the same brush grade performed perfectly.

3. The gas pump d-c motor case

Despite careful laboratory testing by the pump manufacturer, considerable trouble was experienced in finding brushes that would perform satisfactorily under field conditions. The trouble—as shown by Stackpole's investigation—came because the effects of polarity had been disregarded in the pump maker's brush tests. A satisfactory brush was quickly recommended.

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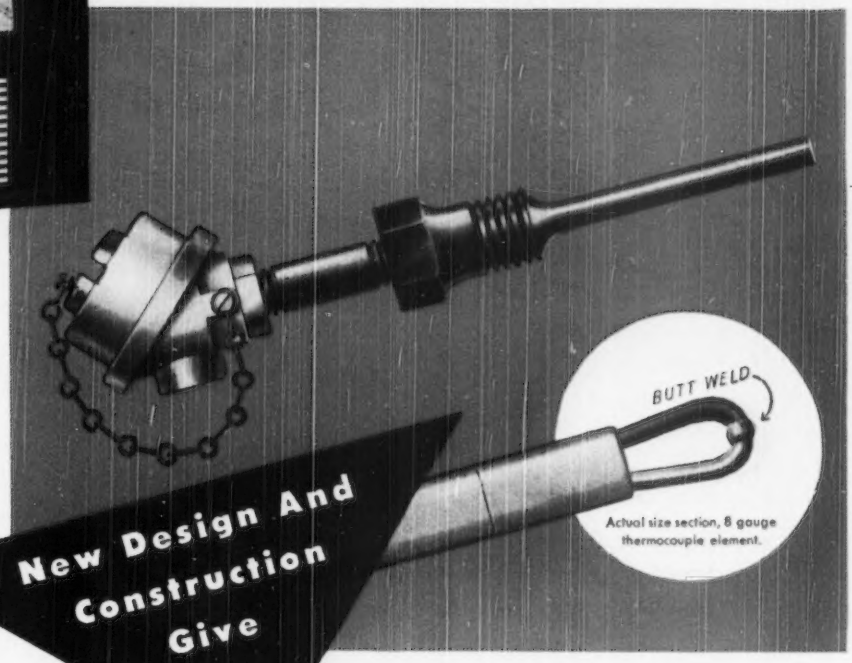

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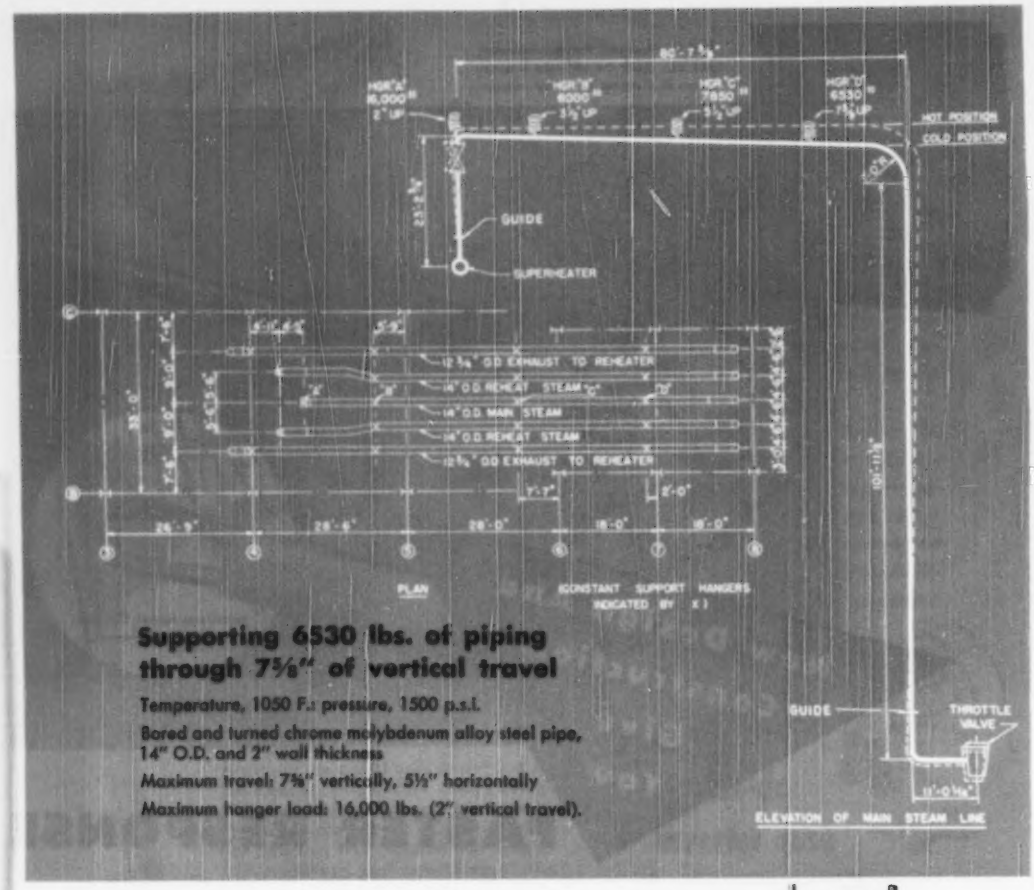

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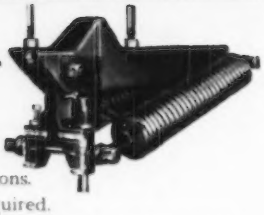

Provides constant support to piping subject to vertical movement — in all hot and cold positions. Maintains full safety factor in supporting high temperature, high pressure piping. Non-resonant and energy absorbing. Mass-produced from standard precision parts. Individually calibrated for each installation. Load-adjustment features incorporated into design. Models to meet entire range of load-travel specifications. Minimum headroom required.

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Yes – "plant safety" is a mutual job.

DON'T FORGET—THE LIFE YOU SAVE MAY BE YOUR OWN

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Quinterra, type 6, being used as interlayer insulation in a Marcus distribution transformer.

MARCUS TRANSFORMER CO., Inc.

MANUFACTURERS AND DESIGNERS OF STANDARD AND SPECIAL TRANSFORMERS

32-34 MONTGOMERY STREET MILLBURN, NEW JERSEY

Mr. B. B. Woodford
Johns-Manville Sales Corporation
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Dear Mr. Woodford:-

Now that we have been using Quinterra electrical insulation for over a year, we believe you will be interested in our experience with it. During this period, we have produced over 10,000 air cooled transformers, ranging in sizes from 1 KVA to 2000 KVA with voltages to 13,800 volts.

When Quinterra was first introduced we became interested. We felt its high temperature dielectric properties and uniform smooth texture would permit us to produce long lasting transformers with better space factor as to insulation thickness. Our beliefs have been completely confirmed. Rejection of completed units under our own severe tests have been practically eliminated. Products are running more uniform in size. Production has increased. Complaints from the field involving Quinterra insulated transformers are negligible compared to what was considered normal previously.

Our use of Quinterra consists primarily of layer insulation and a small amount for our taps and as wrapper and ground insulation. Compared with insulations previously used for these applications, besides getting a far superior product, we found a material saving in our costs. This saving has run as much as 20% for the insulation required in certain transformer sizes.

We believe Johns-Manville has made a vital contribution to the life and safety of electrical devices through its development of Quinterra.

Very truly yours,
MARCUS TRANSFORMER COMPANY, INC.
Alvin Marcus
President

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Can you match these *Quinterra* savings in transformer production?

THIS LETTER from Marcus Transformer Co., Inc. tells about both production and use advantages of Quinterra . . . the revolutionary new purified asbestos, high temperature electrical insulation.

—And it tells about actual savings and customer satisfaction in typical operations with this flexible, continuous sheet insulation. Quinterra is being widely used for interlayer and wrapper insulation in transformers and coils. Its lasting dielectric strength assures a greater safety factor and longer operating life. Quinterra withstands higher temperatures than the hot-spot limit of 130C for Class B insulations.

QUINTERRA

- ✓ **cuts factory rejects**
- ✓ **reduces complaints**
- ✓ **improves production rate**
- ✓ **produces more uniform product**
- ✓ **cuts costs of operations**

Johns-Manville ELECTRICAL INSULATIONS

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In medieval times, a coat-of-arms had an importance that could not be overestimated. It was granted as a personal badge, signifying the attributes and accomplishments of its proprietor—and as such was respected thruout the civilized world. It had no duplicate.

In turn, the emblem imposed upon its owner a responsibility for maintaining an enviable reputation—a condition which stimulated general confidence in him.

Times have changed, but not all *things*. The sense of sanctity of an emblem is prevalent today as it was hundreds of years ago. That is why we take such pride in our trademark: NICHROME.

It is evidence of our accomplishment; our unique, personal badge—respected everywhere. Granted solely and wholly to us by the United States Patent Office over forty years ago, it symbolizes a series of superb electrical heat and corrosion resistant alloys (developed and produced *only* by Driver-Harris Company) which today is serving industry all over the world.

Yes, there are other excellent heat and corrosion-resistant alloys, but *only one* NICHROME—the product of exclusive Driver-Harris knowledge and techniques.

We are well aware of our obligation to maintain its reputation, both here and abroad. In fact, such obligation is an inspiration to give of our best—now, tomorrow, and always.

FIFTIETH ANNIVERSARY

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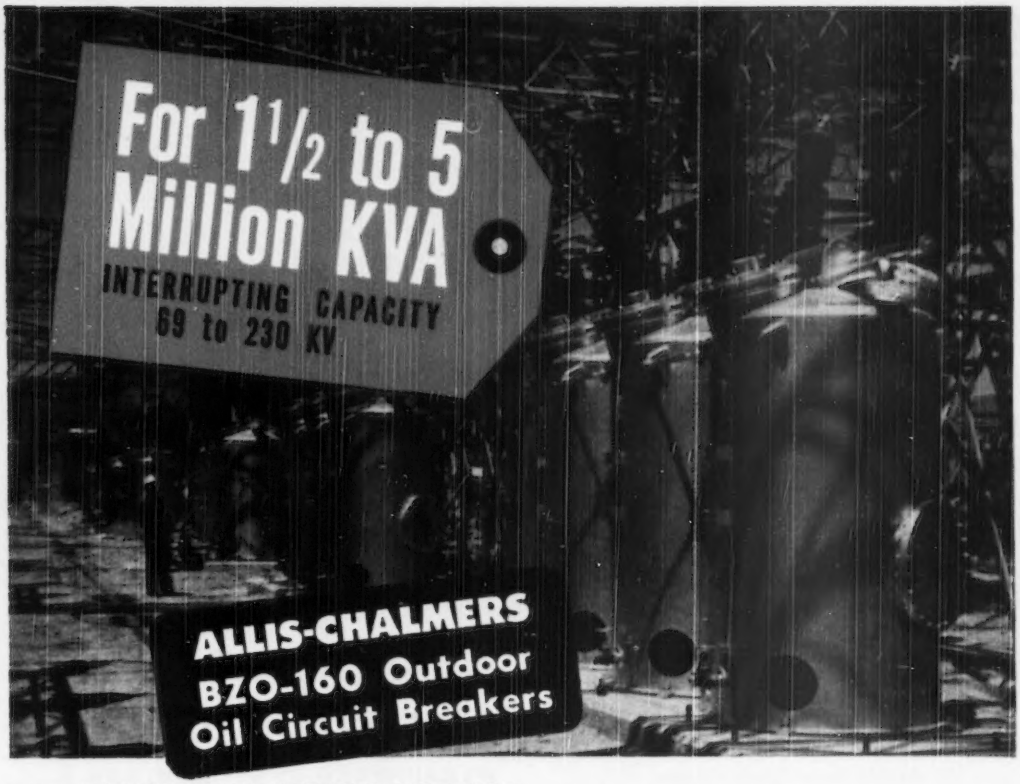

- MECHANICALLY TRIP-FREE OPERATOR *affords high-speed opening*
- RELIABLE HIGH SPEED FAULT CLEARING AND FAST RECLOSING *for system needs*
- EVERY BREAKER COMPLETELY FACTORY ASSEMBLED AND TESTED *before shipping*

MAINTAIN continuity of power service despite transient line faults. The BZO-160 oil circuit breaker clears system faults in 3 to 5 cycles and recloses within 20 cycles to give you protection in ratings 69 kv and higher. Get long-life performance and reliable protection with these BZO-160 features:

1) Mechanically trip-free design gives high-speed contact opening under all operating conditions. Pneumatic operator is uncoupled from the contact mechanism through a positive mechanical linkage. This means that contacts open independent of closing piston position.

2) *Raptor* interrupter gives split-second arc extinction . . . interrupts load and fault currents with low arc energy release. Reduces oil and contact deterioration to a minimum. Arc resistant alloy contact tips give long contact life with little maintenance.

The BZO-160 performance is based upon more than 50 years of circuit breaker design and manufacturing experience, exacting laboratory and field tests, and years of power service. Simple breaker construction, free of complicated mechanisms, makes inspection easy.

For more information on dependable BZO-160 performance call your A-C sales office or write for new bulletin 71B6022C. A-3074

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Rated KV	Rated Amp. 60 cycle	KVA Interrupting Capacity*
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69	2000	3,500,000
115	800	1,500,000
115	1200	3,500,000
138	800	1,500,000
138	1200	3,500,000
138	1200	5,000,000
161	800	3,500,000
161	800	5,000,000
230/196	800	3,500,000
230/196	800	5,000,000
230	800	3,500,000
230	800	5,000,000

*For information on higher interrupting ratings, get in touch with your A-C sales office.

Raptor is an Allis-Chalmers trademark.

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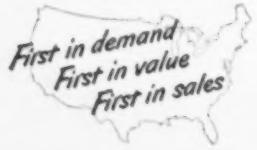

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CUT YOUR COSTS ON EVERY HAUL!

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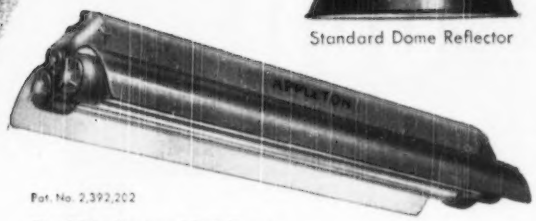

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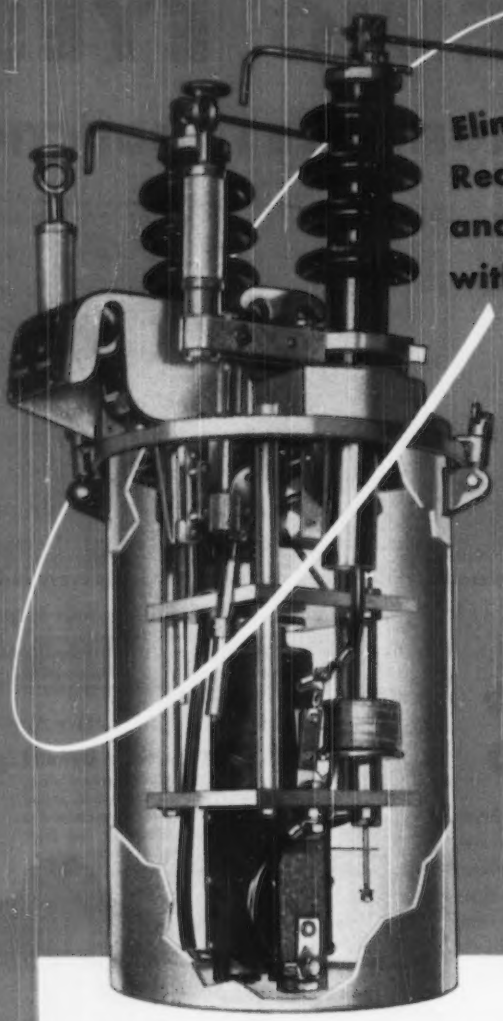

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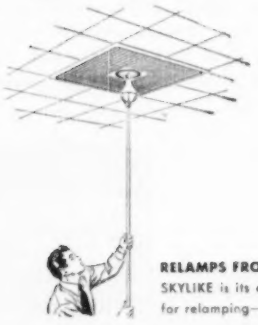
Incandescent advantages

WITH A FLUORESCENT LOOK!

The SKYLIKE System—a new concept of lighting—combines the best features of silvered-bowl incandescent lighting with the architectural advantages of a fluorescent-type troffer. SKYLIKE makes it possible for you to offer your commercial customers something dramatically different, better—and lower-cost!

In fact this new adaptation of silvered-bowl incandescent lighting provides a combination of important practical advantages not found in any other lighting system:

1. **Warm color—most desired by merchandising experts.**
2. **High initial and maintained light output.**
3. **Softly diffused shadows.**
4. **Low brightness and 90° shielding.**
5. **No flickering, blinking, or hum.**
6. **Instant starting.**
7. **Variable lamp size—150- to 500-watt.**
8. **No light loss from darkened walls or ceilings.**
9. **Floor-service relamping—no ladders or scaffolds.**
10. **Hermetically sealed silver reflecting surface.**



RELAMPS FROM THE FLOOR! One of the many features of SKYLIKE is its ease of maintenance. No stepladder is needed for relamping—a lamp changer can be used, as shown.

CONTRACTOR ADVANTAGES

SKYLIKE is good news for electrical contractors, because it has the advantages of simple wiring, light weight and fast installation, and complete freedom from service call-backs.

In addition to all its technical advantages, SKYLIKE is modern, handsome, and versatile in application. Units fit 24" x 24" ceiling tiles, fully or partially recessed, or may be surface-mounted—in rows or patterns. With a simple accessory and a semi-silvered-bowl-lamp, SKYLIKE is converted for directional or accent lighting.

AMAZINGLY LOW-COST!

Because it is so simple—simple in construction; simple in wiring; free of ballasts, starters, and accessories—SKYLIKE is low in cost (½ to ⅓ the cost of equipment delivering comparable results!) Its light weight makes for easy handling, fast installation, and lower-cost supporting construction. There's no transformer or starter maintenance. The 87% reflection factor of SKYLIKE's enamelled ceiling is easily maintained by occasional cleaning with a damp cloth.

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"I'd rather work with this kind"

Ask any lineman which strand he'd rather work with—Bethlehem Form-Set or the conventional type. It's a safe bet he'll choose Form-Set, which is preformed and hence much easier to handle. Not only that—it makes possible a quicker, better job.

Here's why: Form-Set doesn't unravel when cut; it need not be seized. Each and every wire lies calmly in place—there's no bushing out, no wildness. This is because preforming greatly reduces internal tension. The wires have no urge to uncurl, even after cutting.

Does Form-Set cost much more? No! The cost difference between Form-Set and non-preformed strand is so slight as to be negligible. And many users feel that this minor difference is quickly offset by the time saved in the field. Example: Form-Set slides so easily into fittings; there's no time wasted pinching the ends of the wires together.

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Bethlehem *FORM-SET* Strand

BETHLEHEM STEEL

OUR MIDDLEWEIGHT CHAMPS! THEY TIP THE SCALES AT 17,000 TO 25,000 GVW... MODELS HR--HG--HA--HRC

THESE MEDIUM-HEAVIES WIN BLUE RIBBONS IN THE 28,000 TO 34,000 GVW CLASS. MODELS YU--ZU--SU

OUR BIGGEST 4x4 BRUTES WEIGH IN AT 40,000 TO 44,000 GVW MODELS M-7 AND M-10

INTRODUCING THE LD! OUR POPULAR NEW OFFSPRING--THE ONLY *TRUE* LIGHT-DUTY 4x4! A 14,500 GVW WONDER BOY

BIG 6x6 BRUISERS! 30,000 TO 60,000 GVW MODELS M6x6--H6x6 --MU6x6

Meet the whole family!

This line-up in our album covers the big FWD family of *basic* models. You should see the *other* pages... picture-after-picture of both highly specialized and conventional applications... plus photo-proof of economy, safety and spectacular performance... both on and off the highway. Put the *extra-traction* and *proper weight distribution* of this family of bread-winners to work for you, too! See Graybar or write FWD direct.

GET FULL FACTS on 38 standardized FWD truck - and - equipment units for line construction and maintenance.

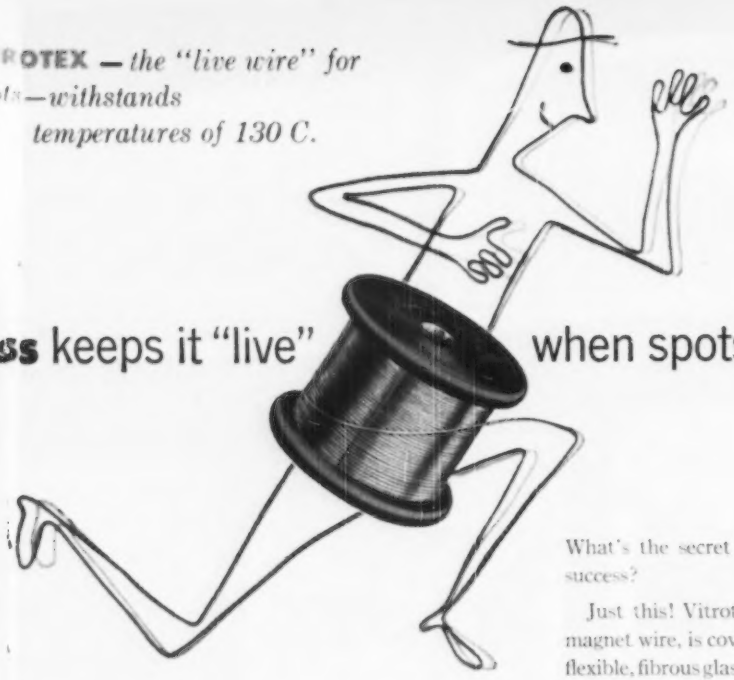
Distributed by GraybaR

THE FOUR WHEEL DRIVE AUTO CO.
Clintonville, Wis. • *Canadian Factory:* Kitchener, Ont.
World-Wide Sales and Service

FWD

America's Foremost Heavy-Duty Truck

VITROTEX — *the "live wire" for hot spots — withstands temperatures of 130 C.*



Glass keeps it "live" when spots get **Hot**

What's the secret of its heat-resistant success?

Just this! Vitrotex*, unlike ordinary magnet wire, is covered with alkali-free, flexible, fibrous glass insulation—bonded with a special, high-temperature varnish. This protects windings against hot spots as high as 130 C. . . . provides high flexibility, excellent heat conductivity and an amazing space factor . . . plus high dielectric strength.

The smooth surface of Vitrotex successfully resists abrasion, moisture, acids, oils and corrosive vapors . . . and its tightly wound coils provide safer operation in confined areas under high heat.

Contact your nearest Anaconda Sales Office or Distributor for information on Vitrotex and the entire line of Anaconda Magnet Wire. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York, or 20 N. Wacker Drive, Chicago 6, Illinois.

50383

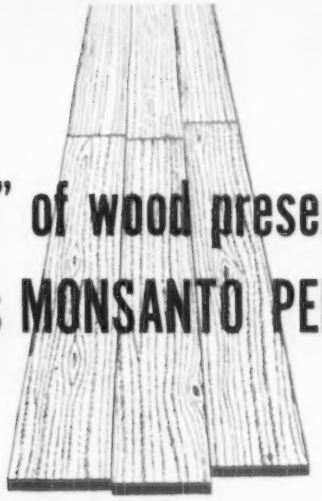
*Reg. U. S. Pat. Off.

the right wire for the job **ANACONDA®**

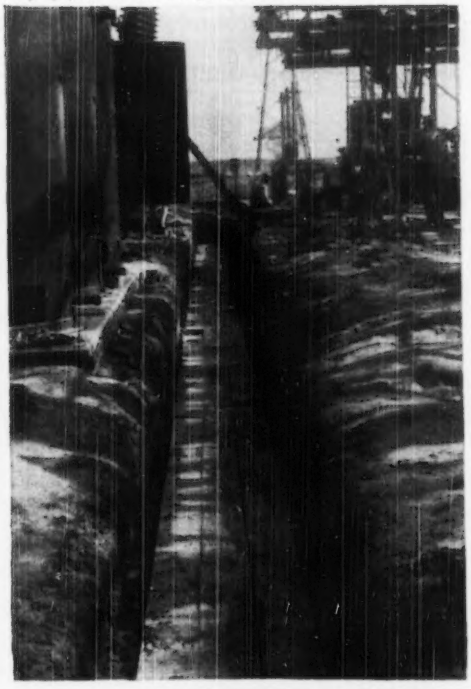
WIRE AND CABLE

for "tough job" of wood preserving, utility chooses MONSANTO PENTAchlorophenol

(Santophen 20)



MONSANTO PENTA protects planks which protect workmen and cables at this Union Electric Company of Missouri substation, near St. Louis.



There was a "tough job" for a wood preservative when Union Electric Company of Missouri built safety for workmen and protection for cables into its new substation at St. Louis. To accomplish this built-in protection, underground conduits were covered with heavy planks so that future workmen would not pierce cables accidentally. Obviously, to give *long-lasting* protection, the planks had to be treated with a *long-lasting* preservative. Monsanto PENTAchlorophenol was applied by pressure process at the rate of 10 pounds per cubic foot of wood.

Monsanto PENTA is a *chemically uniform* material. It *stays* in the wood . . . does not evaporate . . . isn't washed away by rain or ground water. Monsanto PENTA gives *positive protection* against termites and other wood-destroying insects . . . against rot organisms. With properly formulated PENTA treatment, wood can be painted or stained. It can be made water repellent.

If you use wood in any application in which long life of the material is desired, it will be worth your while to investigate Monsanto PENTA. For information, mail the coupon or contact the nearest Monsanto Sales Office. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1758-J South Second Street, St. Louis 4, Missouri

Santophen: Reg. U. S. Pat. Off.

DISTRICT SALES OFFICES:
Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Seattle. In Canada, Monsanto (Canada) Ltd., Montreal.

MONSANTO
CHEMICALS | PLASTICS

MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
1758-J South Second Street, St. Louis 4, Missouri

Please send information on Monsanto PENTA.

Name ..... *Title* .....

Company .....

Street .....

City ..... *Zone* ..... *State* .....

SERVING INDUSTRY . . . WHICH SERVES MANKIND

NEW UTILITY STATIONS C-E EQUIPPED

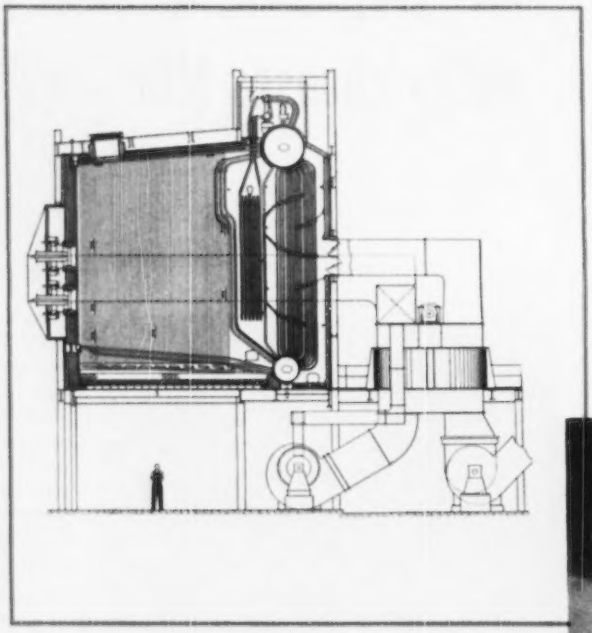
Includes stations placed in operation since the war (in white) and those under construction or being engineered.

TIDD
JENNISON
CECIL LYNCH
HAVANA
MEREDOSIA
PERMIAN BASIN
O. H. HUTCHINGS
REX BROWN
HICKLING
B. C. COBB
RUSSELL
SEWAREN
POSSUM POINT
PORT JEFFERSON
CUTLER
WHITE RIVER
GADSDEN
POTOMAC RIVER
W. SPRINGFIELD
WOOD RIVER
LAKE CATHERINE
HARRY NEWMAN
DAN RIVER
JIM HILL

HUTCHINSON

DUNKIRK
YATES
HAWTHORN
TITUS
LEE
EDGE MOOR
CONTRA COSTA
PALATKA
NINEMILE POINT
BLACK DOG
CLERMONT
MERAMEC
DANSKAMMER
LONG BEACH
ALBANY

NEW



The cross section above shows one of three duplicate C-E Units that were recently placed in service at the Hutchinson Station. They are C-E Vertical-Unit Boilers, Type VU-50, equipped with regenerative type air heaters. The units are designed for firing by natural gas or oil with provision for conversion to coal firing at a later time if desired. Steam is produced at 875 psi at 900 F.

COMBUSTION ENGINEERING

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

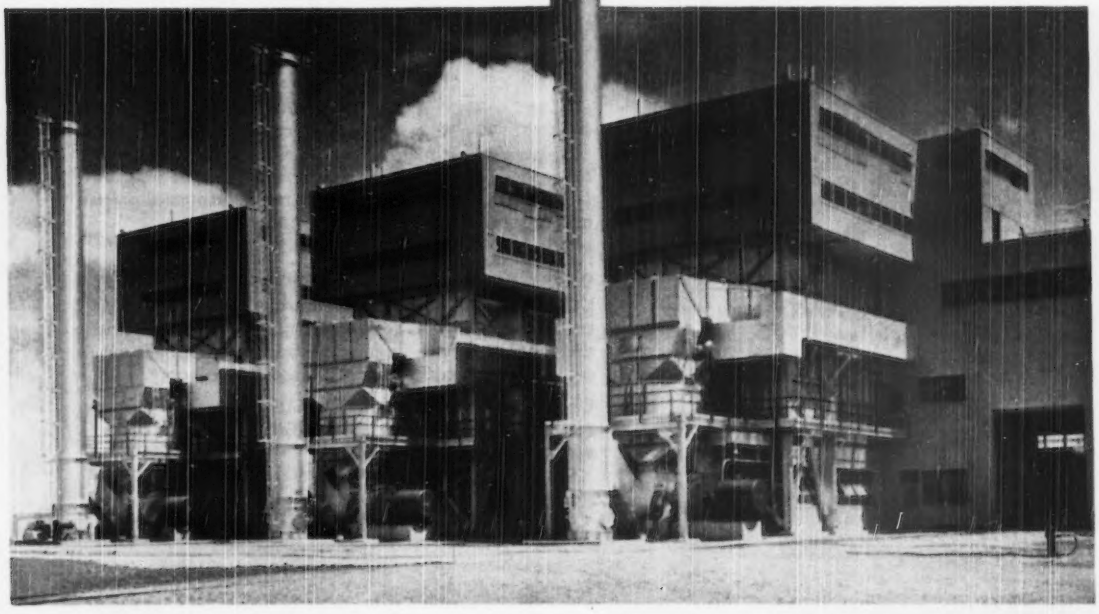
HUTCHINSON STATION GOES INTO SERVICE

Keeping pace with ever growing power demands, The Kansas Power and Light Company's new Hutchinson Power Station placed the first of its new units in service early in May. The second unit was ready about two weeks later, and now all three units are in service.

Hutchinson Station is located at Kilowatt Spur, Kansas, strategically situated to serve the expanding electrical requirements of Hutchinson and surrounding area. The new plant, which was engineered by Black and Veatch, is tied in not only with the entire system of The Kansas Power and Light Company, but with other utility systems in that part of the country.

The two 20,000-kw Preferred Standard turbine-generators which comprise the first section of this new station are served by three C-E Steam Generating Units. A sectional elevation and brief description of these units appears on the opposite page.

B-415



— SUPERHEATER, INC.
200 MADISON AVENUE, NEW YORK 16, N. Y.
C-E

Amcreco CREOSOTED POLES

1 **INCREASES LIFE EXPECTANCY OF YOUR LINES** Carefully selected, naturally strong timber is scientifically pressure treated the entire length to produce poles of highest strength and durability. Service records showing from 25 to 40 years of useful pole life prove the long life expectancy of Amcreco creosoted poles.

2 **LOWERS INITIAL COST . . . REDUCES MAINTENANCE EXPENSE**—Poles of practically constant strength promote pole line economy. Smaller sizes and longer spans are possible . . . a lower factor of safety can be allowed . . . lines stay up longer . . . fewer replacements of poles and cross arms are required.

3 **GIVES DEPENDABLE SERVICE UNDER SEVEREST CONDITIONS**—Lines constructed with Amcreco poles are planned for the future. Built for permanence and dependable service under all conditions, Amcreco creosoted poles provide greater long-term economy.

Get the whole story about long lasting, money saving Amcreco poles. Ask for detailed information on actual service records. Write today.

Amcreco
Lowry Process
Creosoted Products

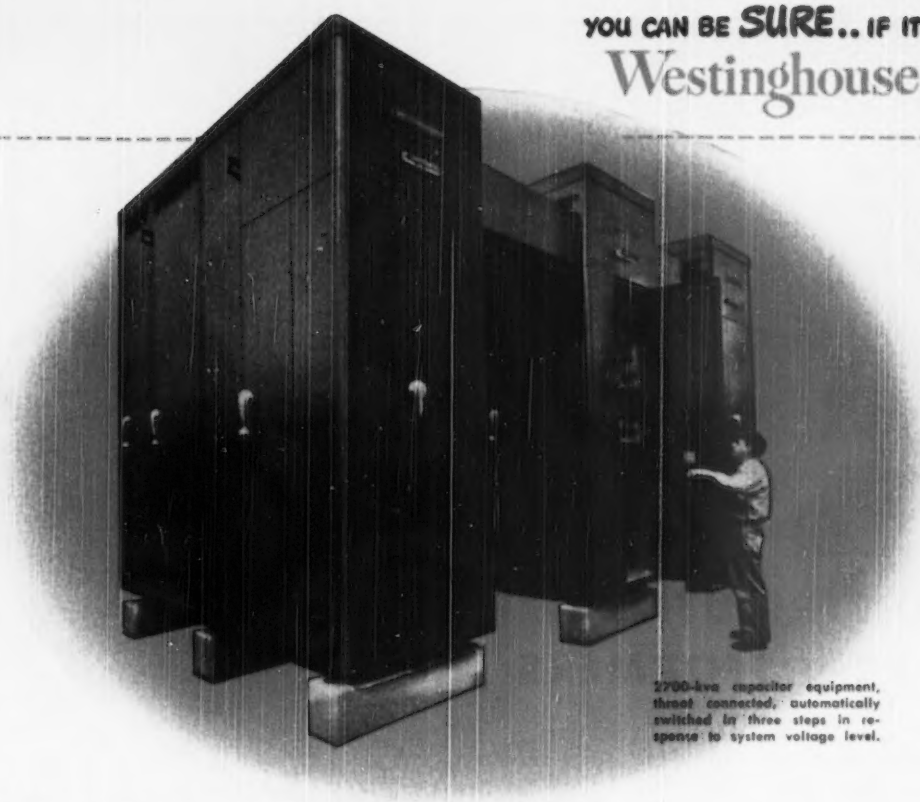
POLES
CONDUIT
CROSS ARMS

AMERICAN CREOSOTING COMPANY
INCORPORATED
COLONIAL CREOSOTING COMPANY
GEORGIA CREOSOTING COMPANY
LOUISVILLE KENTUCKY

Pressure treated for strength that lasts

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



2700-kva capacitor equipment, throat connected, automatically switched in three steps in response to system voltage level.

WESTINGHOUSE HOUSED CAPACITOR UNITS

Keep Voltage—*AND COSTS*—in line!

You can be *sure* of dependable voltage control with Westinghouse Housed Capacitor equipment. You can be *sure* about savings too, because the Westinghouse unit is designed to trim your substation costs. For example . . .

A compact design allows for smaller substation space . . . lower real estate costs.

Factory assembly assures low installation costs. You need only mount the housing on pads, set capacitor units in place, and make primary connections.

Complete interlocking assures safety to personnel—shorting and grounding the capacitors before housing can be entered.

A self-contained design saves the cost of installing external accessories.

Savings like these are supplemented by extra revenue when good voltage control is maintained at the substation. And Westinghouse housed equipment with built-in automatic control—responsive to line voltage, load current or kva load—assures the finest.

For complete information on Westinghouse Inerteen Capacitors, write for Booklet B-4343. Address: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60723

Westinghouse

CAPACITORS

For

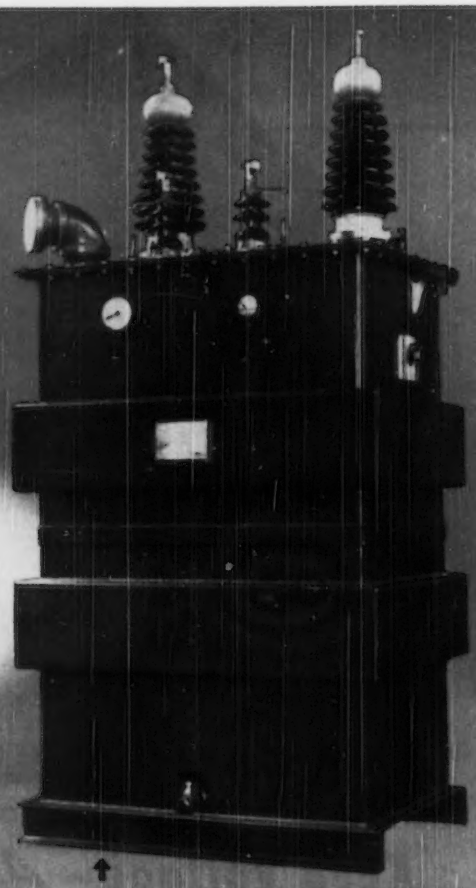
High Voltage Circuits

Uptegraff DISTRIBUTION TRANSFORMERS

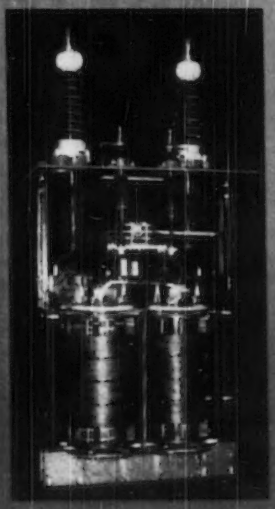
Built for operation up to 115,000 volts, Uptegraff High-Voltage Distribution Transformers are designed to meet all conditions encountered in this service. Insulation design is fully coordinated for all recognized operating conditions. In these designs, the same even distribution of potentials has been achieved as in lower voltage transformers, by avoiding corona and points of high dielectric stress. Long life and continuous service are provided for by the elimination of insulation "hot spots."

Uptegraff High Voltage Transformers are vacuum-filled, to prevent air inclusions. They conform with NEMA and ASSA standards.

Prompt deliveries can be arranged.



333 EVA Uptegraff Distribution Transformer, oil-immersed, self-cooled, 66000—7200/12470 Y volts.



Core and Coil assembly, as seen from the low voltage side.

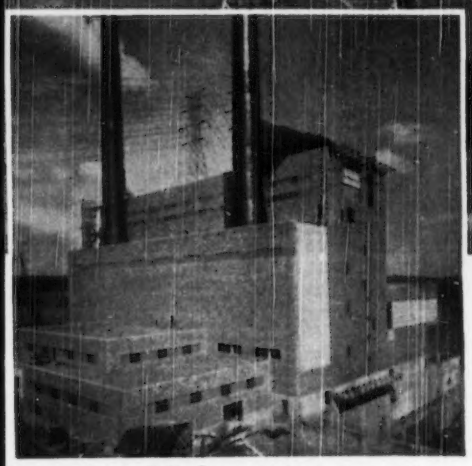
Uptegraff TRANSFORMERS

POWER · DISTRIBUTION · INSTRUMENT SPECIALTY

R. E. UPTEGRAFF MANUFACTURING CO.

SCOTTDALE, PENNA.

A new "high" in tower dependability and economy



American Bridge Company fabricated and erected the structural steelwork for the new Philip Sporn Plant, which utilizes four of the largest steam generators in the country.

These 240-ft. river crossing towers are among the highest in use. They're double circuit, 132 kv towers carrying six 477,000 CM, ACSR conductors and one 159,000 CM, ACSR ground wire.

"Streamlined" towers handle heavy duty job for A. G. E. System

THE tall, double-circuit towers shown above are among the approximately 160 erected to join the new 550,000-kw Philip Sporn Plant at Graham Station, W. Va., to the 132 kv transmission network of the American Gas and Electric System.

Designed and fabricated by American Bridge Company, these steel towers stand as proof of the soundness of "streamlined" towers—stripped of all non-essentials—for even the heaviest duty. Equipped with steel grillage earth anchors, they offer the added economies of simplified installation and frill-free construction that resists wind and wintry weather.

American Bridge has been designing, fabricating and erecting transmission towers for the nation's leading power companies for forty-five years. Its experience and facilities are second to none. Why not submit any questions you might have to our nearest Contracting Office? An inquiry involves no obligation.

AMERICAN BRIDGE COMPANY

General Offices: Frick Building, Pittsburgh, Pa.

Contracting Offices in: AMBRIDGE · BALTIMORE · BOSTON · CHICAGO · CINCINNATI
CLEVELAND · DENVER · DETROIT · DULUTH · ELMIRA · GARY
MINNEAPOLIS · NEW YORK · PHILADELPHIA · PITTSBURGH
PORTLAND, ORE. · ST. LOUIS · SAN FRANCISCO · TRENTON
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

AMERICAN BRIDGE

UNITED STATES STEEL

Two new 80,000 kw turbo-generators recently installed at the Mitchell Station of West Penn Power Company.

GULFCREST OIL selected

for two more big turbine units— ***80,000 kw. each***

Two more big turbines get the safe, sure, long lasting protection of Gulfcrest, now more than ever the world's finest turbine oil!

Another case, too, where outstanding performance in other turbines operated by the same utility led to the selection of Gulfcrest Oil for the new units.

After extra refining by Gulf's exclusive Alchlor Process, Gulfcrest is now enriched with a remarkable new oxidation stabilizer—another important Gulf Research development. This additive greatly improves Gulfcrest's already exceptional chemical stability.

And—the new Gulfcrest Oil has been fortified to provide an even more effective rust preventive film—it completely protects all oil-bathed surfaces against rust.

Ask a Gulf Lubrication Engineer to give you all the facts on the new improved Gulfcrest Oil. Write, wire, or phone your nearest Gulf Office today.

Gulf Oil Corporation · Gulf Refining Company

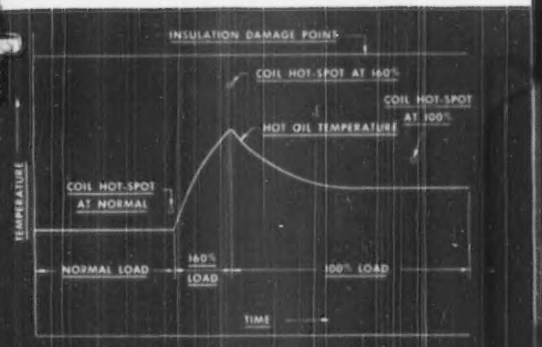
GULF BUILDING, PITTSBURGH, PA.

Sales Offices - Warehouses
Located in principal cities and towns throughout Gulf's marketing territory

GULF INDUSTRIAL LUBRICATION

Get Real overload protection

with L-M ROUND-WOUND CSP Transformers



L-M Round-Wound CSP's undergo thorough and complete testing during and after assembly. They are available in sizes from 3 to 50 kva, 2400 to 14,400 volts. They provide complete protection against lightning surges, overloads and burnouts, and system faults.

● For 14 years utility men have enjoyed the *dual* protection given by L-M's Completely Self-Protected Round-Wound distribution transformers:

> Protection for the transformer and the system, by the CSP features—expulsion lightning arresters, primary fuses, and secondary breaker . . .
>
> Extra protection through the thermal characteristics of the Round-Wound design, which provides exceptional high short-time overload capacity.

Arresters, fuses, and breaker protect the *transformer* itself against lightning surges and overloads, and protect the *system* against faults in case of winding failure. The breaker operates on both overloads and temperature rise, disconnecting the load whenever it reaches an unsafe level. In case of secondary short circuits or exceptionally heavy overloads the breaker quickly interrupts the secondary service. Breaker operating handle, with built-in signal light in larger sizes, permits convenient and safe resetting of the breaker—and the usual complete protection is continued. Included is a simple control for use in emergencies to provide that extra overload capacity inherent in the Round-Wound transformer.

Round-Wound's Extra Safety Margin. Under overload conditions, L-M Round-Wound transformers offer a *real* advantage. They have an inherently low gradient between "hot-spot" and top oil temperature. *Long round* coils have large cooling surfaces; *oil ducts* within the windings and between coils and the cruciform-shaped core provide a tremendous cooling capacity. These all contribute to exceptionally low copper temperatures *even* under overload conditions.

Get the whole story

Construction, features, dimensions, and application information on L-M CSP's are available in Bulletin DT3. Ask the L-M Field Engineer for a copy or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

6

LINE MATERIAL... Transformers

L-M Announces

a revolutionary new development in transformer oil

"ORTO"* brand oil is a revolutionary new inhibited oil that resists oxidation, acidification, and sludging. It lasts several times as long as a high-grade conventional oil. Therefore it offers these advantages:

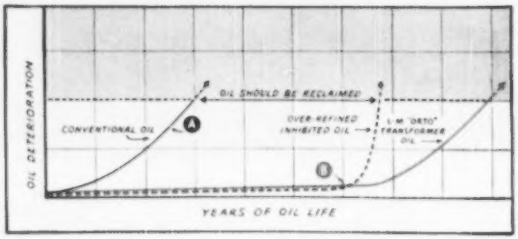
1. **Improved overload capacity**
2. **Longer transformer life**
3. **Lower maintenance costs**

"ORTO" brand oil has been thoroughly tested. Its advantages are conservatively stated. It does not deteriorate suddenly after the inhibitor has been used up. In "ORTO" the inhibitor lasts many years. After that the oil still has inherently long life, with normal resistance and characteristics; and it then simply begins the normal rate of deterioration.

All this time "ORTO" has kept cooling oil passages clear of sludge, permitting the original unrestricted oil circulation, and maintaining the original high short-time overload capacity. By preventing the formation of acids, "ORTO" has protected cellulose insulation from deterioration, and has prevented the corrosion and rust caused by acidified oil.

"ORTO" brand oil is now available exclusively in L-M Round-Wound and other L-M distribution transformers.

Ask the L-M Field Engineer for complete information, or wire or write Transformer Sales Department, Line Material Company, Zanesville, Ohio (a McGraw Electric Company Division).



Comparative curves show the deterioration of transformer oil in service. A high-grade conventional oil deteriorates at a gradually accelerating rate. Over-refined oils may have a better response to the inhibitor, but once the inhibitor has been used up, the oil has little resistance to oxidation, and deteriorates rapidly. "ORTO" brand oil is a high-grade conventional oil with an inhibitor which greatly extends the beginning of the deterioration, which, when it finally starts, assumes the same gradual curve as with any high-grade conventional oil.

*Trademark

10-1

LINE MATERIAL... Transformers

Complete Coordinated Equipment for Distribution Today

ROUND COILS LM WOUND CORE

REG. U.S. PAT. OFF.

protected with
oxidation resistant
ORTO
transformer oil

GET THE ADVANTAGES OF
L-M ROUND-WOUND TRANSFORMERS
. . . NOW EVEN GREATER
WITH "ORTO"* OIL

Among the many advantages of L-M's exclusive Round-Wound design are high short-time overload capacity, high impulse strength, and long life for the transformer, with low maintenance and low operating costs.

These advantages have been outstanding, even in L-M Round-Wound transformers using high-grade conventional oils.

Today, L-M Round-Wounds (and other L-M distribution transformers) are supplied filled with "ORTO" brand oil. Because it is a high-grade inhibited oil, "ORTO" greatly enhances the advantages inherent in the Round-Wound design. Because "ORTO" maintains its original condition for many years, the transformer itself maintains its initial high overload capacity for a much longer time.

Because the oil is kept free from acids, insulation is not subject to deterioration by oil acids; and the transformer maintains its high impulse strength for a far longer period.

Because all parts of the transformer share in the long life, maintenance costs are lower, and operating costs remain at a low level for a much longer period. Thus with "ORTO" brand oil, L-M Round-Wound transformers offer an even greater return on the investment to their users.

look for the Green Shield!

L-M distribution transformers with "ORTO" brand oil are available in conventional, Completely Self-Protected, and subway types, single-phase and three-phase units. For information ask the L-M Field Engineer, or write Line Material Company, Transformer Sales Department, Zanesville, Ohio (a McGraw Electric Company Division).

*Trademark

LM

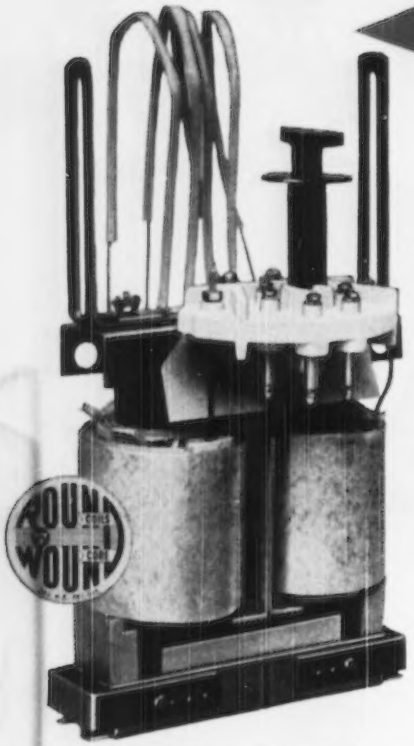
10-4

LINE MATERIAL... Transformers

Complete Coordinated Equipment for Distribution Today

to make 3's and 5's out of 1½ kva transformers

. . . L-M's "UNIVERSAL" core-coil assembly



You can make 3 and 5 kva transformers out of your present surplus or overloaded 1½ kvas, easily, economically, with L-M's new "universal" core-coil assemblies. These fit practically all 1½ kva tanks of any make, and can be installed in your own shop, or by one of the L-M-Authorized Transformer Service Shops.

These "universal" core-coil assemblies are Round-Wound design, with all the advantages this design offers in exceptional cooling and other performance characteristics. Both 3 and 5 kva sizes come in 2400, 4800, 7200 and 7620 volts.

Use these L-M Round-Wound core-coil assemblies for quick replacement in emergencies, burnouts, or in the routine business of making big ones out of little ones when 1½'s no longer give your customers enough of what you sell.

They are available from stock in L-M factories or at any of the 45 L-M warehouses throughout the country; or for installation by L-M-Authorized Service Shops.

For details, installation instructions, specifications, ask the L-M Field Engineer or write Line Material Company, Transformer Division, Zanesville, Ohio (a McGraw Electric Company Division).

L-M Round-Wound "Universal" core-coil replacement assemblies are completely dried, impregnated, and shipped in moisture-tight containers. For immediate delivery from warehouse nearest you. 3 and 5 kva, 2400, 4800, 7200 and 7620 volts; fit all makes of tanks, from 1½ kva up. Same high quality characteristics and cooling as complete L-M Round-Wound transformers.

Some of the L-M-AUTHORIZED Transformer Service Shops

It is not necessary to send transformers to the Zanesville Plant—except for those in the Zanesville area. L-M's nearest Authorized Transformer Service Shop will give you dependable service.

Daley Electric Company
960 East Van Buren Street • Phoenix, Arizona

Dowzer Electric Machinery Works, Inc
First and Castleton Streets • Mount Vernon, Illinois

Electran Company
4546-50 N. E. Alberta Street • Portland 13, Oregon

Interstate Electric Company
South 5th and E Street • Fort Smith, Arkansas

Jones Electric Repair Company
715 East 7th St. • Charlotte, North Carolina

Larsen-Hague Electric Company
11510 South Alameda Street • Los Angeles 2, California

Southwest Electric Company
2617-21 South Agnew • Oklahoma City 8, Okla.

Line Material Company Plant
Zanesville, Ohio

For dependable transformer service...

L-M-Authorized Service Shops provide complete equipment for repairs, genuine Round-Wound rewinding, and all necessary testing facilities.

LINE MATERIAL... Transformers

Complete Distribution Equipment for Distribution Today

YOU WOULDN'T PAINT A SAFETY PIN!

It's Stainless Steel!

Today people like Oakville Company Division of Scovill Mfg. Co. are making doubly sure that the diaper set won't get rust in its pants, by making safety pins of stainless steel!

THEY DON'T PAINT THESE STREAMLINERS!

They're Stainless Steel!

Stainless steel trains, like this one by Budd, never need painting. Stainless steel just doesn't rust, doesn't corrode, doesn't do anything but go on and on. Photo shows one of the Burlington's Denver Zephyrs which, after 13 years service, recently came in for their first major overhaul. They needed only polishing to make them shine like new again.

and you don't have to paint CAPACITORS, either ... WHEN YOU GET

L-M ELEMEX CAPACITORS

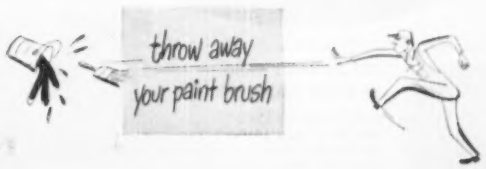
IN STAINLESS STEEL TANKS

Throw away your paint brush—the war against rust is over—so far as power capacitors are concerned. Of course, the payoff is to get ELEMEX capacitors that come in stainless steel tanks that never need painting. ELEMEX capacitors have been on the market for six years, and for the last two in stainless steel tanks, "Hydis"-treated for high heat dissipation. They've got a marvelous performance record.

Lots of other features and advantages: low unit stress makes ELEMEX capacitors last and last . . . L-M "Lifetime" solder-sealed bushings assure positive hermetic seal . . . "Paragroove" connectors make the hook-up so simple; you don't need to cross leads, or lose a lot of time when you replace with larger size ELEMEX capacitors.

Made by L-M's unique and highly effective continuous method of individual evacuation, drying, and impregnation with ELEMEX dielectric liquid, with constant testing during the process. Nothing like it!

Want even more? Well, there's lots more to tell—details, other features. Ask the L-M Field Engineer for copy of our ELEMEX Bulletin or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



LM

LINE MATERIAL . . . Capacitors

Complete Coordinated Equipment for Distribution Today

Why KYLE Reclosers outsell all other makes

Kyle single-phase type H and three-phase type 3H oil circuit reclosers have certain well-recognized advantages that are responsible for their wide leadership.

Kyle reclosers offer the widest choice of operating sequences. Sequences and ratings are easy to change, right in the field. Positive toggle action, fast opening and closing; do not depend on gravity; no motors or clockwork. Hydraulic mechanism is simple, trouble-free. Many safety features.

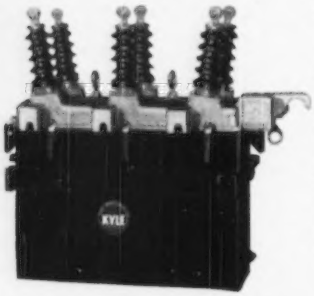
L-M offers the widest variety of reclosers. More Kyle reclosers are sold than all others, and L-M engineers have more recloser experience. Kyle reclosers are rugged, accurate, dependable. More economical to operate than fuses; their accurate coordination eliminates service calls and improves service.

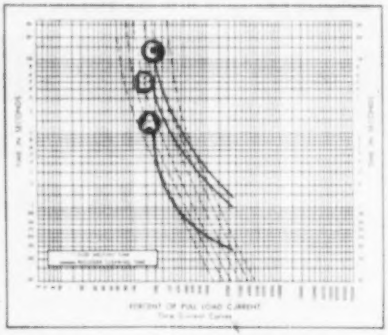
KYLE type H single-phase oil circuit recloser

Has all the Kyle safety features. Trip-free operating handle. Bushing terminals only live parts. Internal by-pass arrester. Sleet hood protects reset handle and operations counter.

KYLE type 3H three-phase oil circuit recloser

Provides individual reclosing and resetting on each phase for temporary faults; but if fault does not clear after three operations, recloser locks out all three phases simultaneously.





Only KYLE reclosers offer 3 operating curves, 7 sequences

Choice of three operating curves. In the chart, the time-current curves shown are A, fast operation; B, retarded operation; C, extra-retarded operation.

Choice of seven operating sequences. The following sequences can be obtained, quickly and easily, right in the field, without shop trips:

4 A's (four fast operations); 4 B's; 4 C's; 2 A's, 2 B's; 2 A's, 2 C's; 1 A, 3 B's; 1 B, 3 C's.

For 2.4 to 15 kv; six ratings from 5 to 50 amps; minimum trip currents from 10 to 100 amps; interrupting capacities from 150 to 1200 amps. Coils are quickly changed, *right in the field!*

GET THE WHOLE STORY ON AUTOMATIC PROTECTION

Ask the L-M Field Engineer for a copy of Recloser Bulletin CR1, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL... Kyle Reclosers

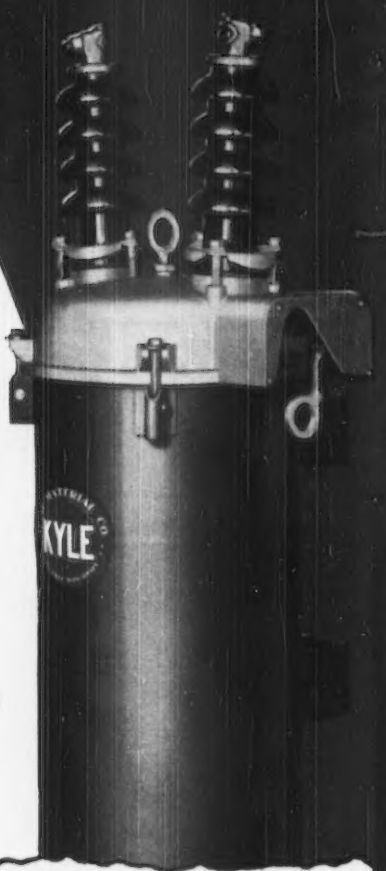
Dependable Coordinated Equipment for Distribution Today

KYLE

TYPE "L" OIL CIRCUIT RECLOSER NOW GIVES YOU UP TO

6000 amps interrupting capacity

IN NEW 140-AMP RATING



First recloser actually engineered for heavy-duty service . . . full power-class design . . . 110 kv insulation impulse level . . . ratings up to 140 amps . . . only real heavy-duty recloser in its class

Kyle type "L" reclosers cost a little more than lighter-duty reclosers, but they're worth the difference in service, performance, convenience, and freedom from maintenance. Even if you don't need the extra interrupting capacity now, you will need it to take care of future loads; and in the meantime you enjoy all the benefits of type "L" performance and economy.

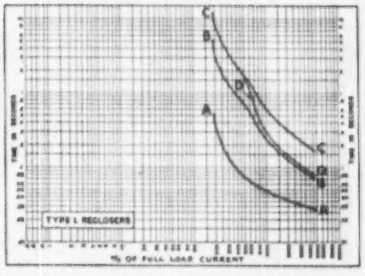
It's the Kyle oil cross-blast method of arc extinguishing, plus heavy-duty design, that makes it possible for the "L" to handle heavy fault currents up to 6000 amps.

The type "L" is the only recloser with so wide a choice of operating sequences. Four standard curves permit any sequence of operation to meet your coordination problems.

Sequence and coil changes are made right in the field—in a few minutes. To change to a coil of different rating, you just remove two screws. To change operating sequence, simply rotate a disc or change one small part. It's quick—and easy! Saves shop trips!

Extremely accurate; virtually no effect from ambient temperature changes. Positive fast operation; positive toggle closing—doesn't depend on gravity. Many safety features: cover and tank electrically dead—bushing tops only live parts; trip-free operating handle. Large sleet hood protects counter and operating handle; may be rotated in 90° steps. Rugged; shock-proof; trouble-free.

ONLY RECLOSER WITH 4 OPERATING CURVES



RATINGS

Coil Rating Amperes	Min. Trip Current Amperes	Maximum Interrupting Capacity Amperes At Maximum Phase-to-Phase Nominal Voltage of		
		4.8 kv	7.2 kv	14.4 kv
25	50	1500	1500	1500
35	70	2100	2100	2100
50	100	3000	3000	3000
70	140	4200	4000	3000
100	200	5000	4000	3000
140	280	6000	4000	3000

Read all about it!

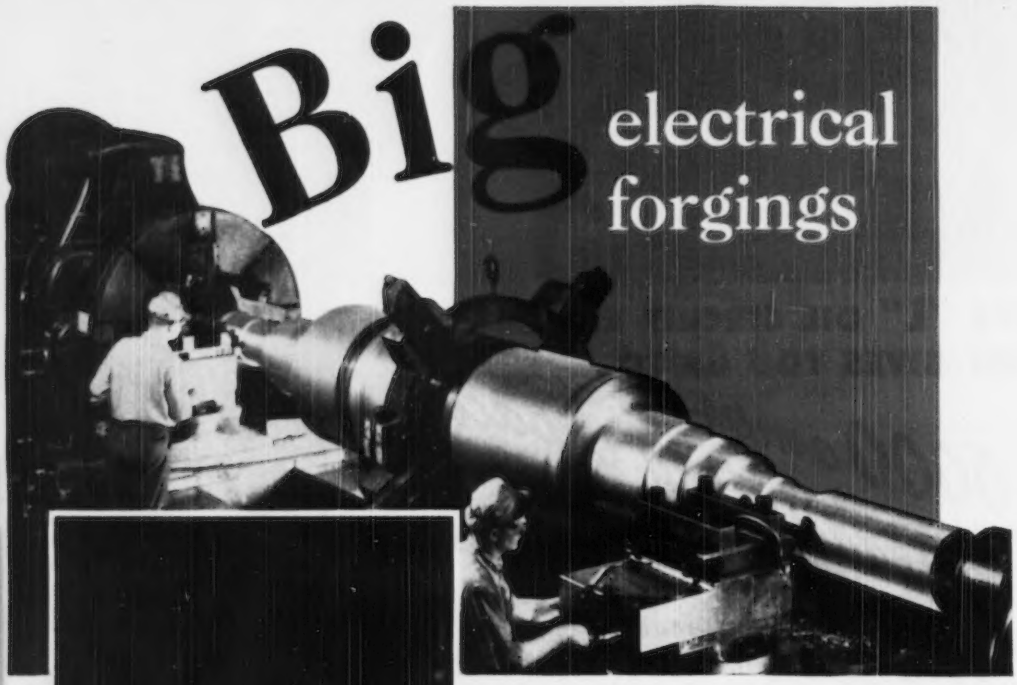
Ask the L-M Field Engineer for a copy of Bulletin CR1A—on the type "L"; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

18

LINE MATERIAL... Kyle Reclosers

Complete Coordinated Equipment for Distribution Today

Big electrical forgings



● Some mighty big forgings are being made at the Homestead District Works of Carnegie-Illinois Steel Corporation. It's a common sight to see forgings of various designs and sizes weighing approximately 300,000 pounds. But despite their size, the quality is comparable to smaller forgings that are much easier to work and handle.

Here are some reasons: We make our own steel; and every step is controlled by Carnegie-Illinois metallurgists. The ingots are forged in our own shop, on our own presses, by men who have had long experience in forging. Skilled machinists rough or finish machine every forging. And they have excellent turning, boring and planing equipment to do it.

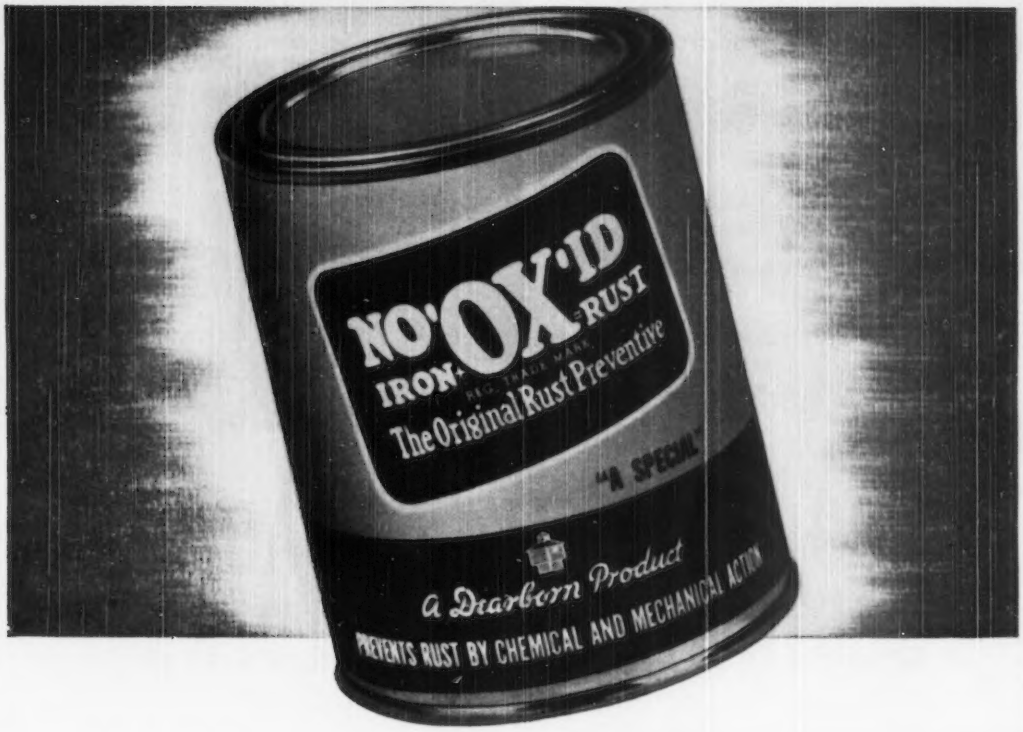
The combination of these things—the steel, the men, the equipment—is your best assurance of quality forgings, produced in accordance with your requirements.

Just give us a chance to quote on your heavy forging requirements. Deliveries are prompt.

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH · COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS Commercial Forgings

UNITED STATES STEEL



KEEP METAL SURFACES AND CONTACTS *CORROSION FREE* WITH NO-OX-ID "A SPECIAL"

It's a simple matter to eliminate formation of oxides, sulphides and other corrosion deposits on metal surfaces and contacts. Just coat the part with NO-OX-ID "A Special" . . . the Dearborn rust preventive of a hundred uses in the utility field.

NO-OX-ID "A Special" is a heavy duty, chemically inhibited compound recommended by manufacturers to provide trouble-free joint connections . . . impervious to weather, corrosive fumes, high humidities, water immersion. It is economical to use, easy to apply, easy to remove.

Check the advantages of NO-OX-ID "A Special." Put it to profitable use in your shops . . . on maintenance and repair trucks. Mail the coupon for further, helpful information.

USES

Bus bars	Steel conduit
Contact points	High line towers
Switch blades	Brackets
Transformers	Insulators
Aluminum cable	Wire
Connectors	Aerial cable
Clamps	Turnbuckles
Steel light poles	Manhole hardware

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THE ORIGINAL RUST PREVENTIVE
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Chicago 4, Illinois

Gentlemen: Please send booklet on NO-OX-ID "A Special."

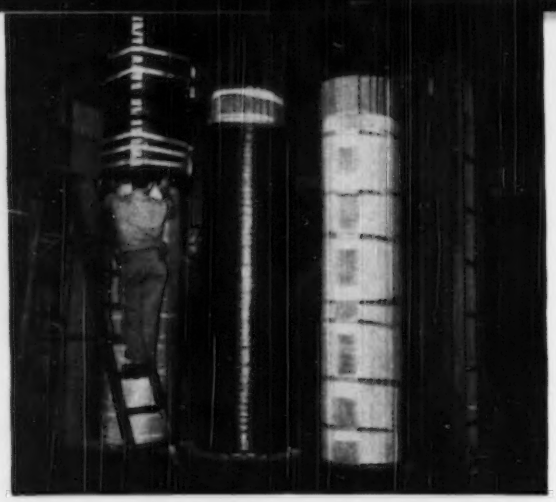
Name.....

Company.....

Address.....

City.....*Zone*....*State*.....

1 PLANNING BEST WAY to expedite vital 20,000 kva power transformer from drawing board to installation, A-C engineers Maise, Ashbaugh and Cook review specifications.



2 20 TONS of high-grade electrical steel is built into core. Core is 5-legged double magnetic circuit design, to keep tank height low. Cap protects low voltage coil from abrasion as it is lowered on core leg.

20,000 KVA TAKES LOAD OFF SOUTHWEST'S SHOULDERS

3 TO WITHSTAND PRESSURE of tons of oil, tank seams will be tested at a vacuum of 28" mercury. Submerged arc welding process produces a controlled, continuous weld.

FROM AIR CONDITIONING SYSTEMS for skyscrapers to mile-deep oil wells, new commercial and industrial load requirements placed a heavy burden on the power distribution system of an expanding Southwest city.

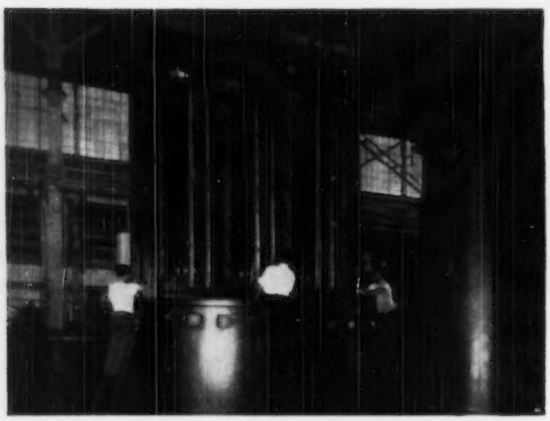
Until . . . this 20,000 kva Allis-Chalmers power transformer was installed to serve the downtown network area, and several outlying substations.

Whether 20,000 kva or the world's largest physical size transformer, such as recently completed, Allis-Chalmers has the engineering experience and facilities to build power transformers of *any* rating . . . to meet *any* system needs.

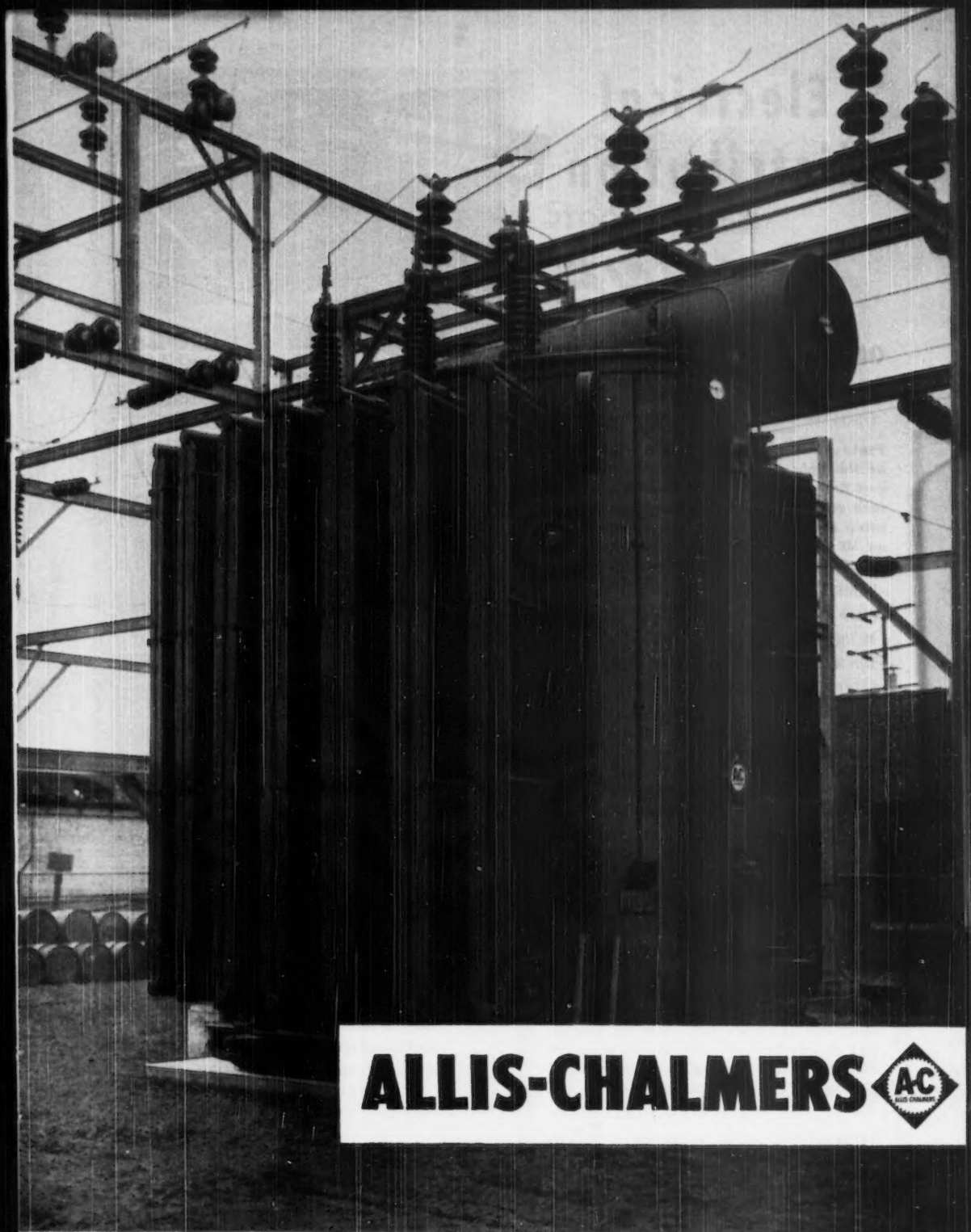
A-2982

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE. WIS.

4 HUGE 400 TON HYDRAULIC PRESS assures a high degree of accuracy in fabricating bosses, frames, covers, etc. Press is also used to dome cover so that it will shed water.



5 DOWN SHE GOES for a preliminary fit. This permits faster tanking after dry-out to maintain high dielectric strength of insulation. Notched end plates guide and accurately position assembly.



ALLIS-CHALMERS

6 MORE POWER TO SOUTHWEST! Not alone relief from heavy power demands today, but faithful power for years to come. The specifications: "20,000 kva, 3-phase, 60-cycle, 55°C rise, *Oil-Sealed* inert gas system, 66,000 volts Y to 13,800 volts Delta" . . . as fine a power transformer as years of engineering background can produce! *Oil-Sealed* is an Allis-Chalmers trademark.

Electrical distribution

IS THE

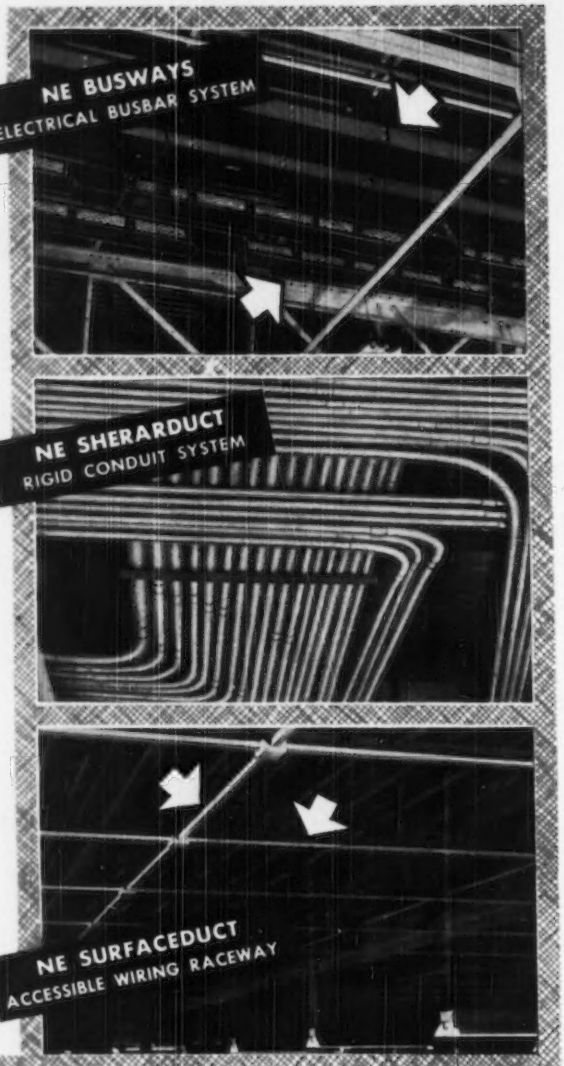
LIFELINE

OF EVERY INDUSTRIAL PLANT

IT SHOULD BE SELECTED
WITH PROFESSIONAL CARE

Professional men know that the selection of the *right* electrical distribution system and the way it is laid out have an important effect on plant efficiency and operating costs. They also know that there is an NE system to fit *every* plant, because *NATIONAL ELECTRIC* makes them all:

- **INDUSTRIAL BUSWAY SYSTEMS**
- **RIGID AND FLEXIBLE CONDUIT SYSTEMS**
- **METALLIC-SHEATHED WIRING SYSTEMS**
- **NON-METALLIC-SHEATHED WIRING SYSTEMS**
- **SURFACE METAL RACEWAY SYSTEMS**
- **INSULATED WIRES AND CABLE of all types including:** Building wires and cables • Power cables • Appliance and equipment wires and cables • High-temperature wires and cables • Signal and control circuit wires and cables • Special wire and cables made to your own specifications.



National Electric
PRODUCTS CORPORATION

Public Utility Representatives—Consulting Engineers—Plant Engineers: YOU should have National Electric's specifications, layout suggestions and informative literature to help you select and lay out the *right* electrical distribution system for *any* plant. Let us send you these helpful engineering data books at once. The coupon is for your convenience.

EVERYTHING IN WIRING POINTS TO

NATIONAL ELECTRIC PRODUCTS CORPORATION
1303 CHAMBER OF COMMERCE BUILDING, PITTSBURGH 19, PA.

Please send me your literature on:

- ☐ **Industrial electrical bus systems**
- ☐ **Rigid conduit systems**
- ☐ **Multi-outlet strip; Surface Metal Raceways**

Name _____

Company _____

Address _____

_____

This Is No Time to Stop Selling

No one knows whether or not another world war is in the immediate offing. Meanwhile—and the meanwhile may last a long time—we are living in a half-world that is neither peace nor war. This condition poses tough questions for all business men. To power company managements one such question concerns the future of their sales organizations.

With some conspicuous exceptions, the sizes of these organizations are nothing much to brag about. In March this year Electrical World published the results of a survey that showed up great deficiencies in them. There undoubtedly has been improvement since then. But the slow pace of their rebuilding since the war prevents any confidence that the improvement has been large.

Compared, however, with the post-war years up to 1949, when they were almost non-existent, power company sales forces are now quite impressive. They have been built up practically from scratch. Not a spectacular, but at least a fairly respectable job has been done in recruiting and training staffs to sell electric service.

If all-out war does come, power company sales departments will practically dissolve as they did in 1942. But to anticipate that possibility by major cutting of sales activity now would be far from wise. To do so would be deliberately to throw away the cost in time and money that has been expended in building up sales departments to present strength and effectiveness, to throw away also the very large benefits that can be realized from aggressive selling even in these murky days. We don't believe any great number of companies has done this so far, but the temptation is there.

Manufacturers of consumer goods for the utilization of electricity in the homes and working places of the nation are still producing at the highest rate they can achieve. At least one large maker of electric appliances has already announced a new line for 1951 and is embarked on a most ambitious promotional campaign. Others may follow suit, if only to hold their competitive positions. At any rate, it is certain there will be no dearth of electrical goods for the consumer market unless and until the hand of war clamps down.

The recently authorized control of consumer credit, with its requirements of larger down payments and shortening of pay-off time, puts a brake on buying. It will make the prospective buyer stop and consider before he signs the installment contract. If he puts down all his ready cash as first payment on an overstuffed living room suite and sees it taking a bigger bite out of his income than he anticipated, he is not likely to sign up for an electric range. The competition for the consumer's dollar is going to be a lot tougher than it has been because other industries want that dollar and are keeping their salesmen to get it.

These facts—the continuing availability of electrical goods and the restriction on the prospect's freedom to buy—argue strongly against any slacking off in electric utility sales activity. It is to be remembered that it was the appliances sold before 1942 that kept the residential usage of electricity growing through the war years and for a considerable time after. If another war comes the utilities will want that usage again to continue to grow. To assure that requires selling now. And you can't sell if you fire your sales force.

Higher Transmission Voltages

HIGHER VOLTAGES for transmission are on the way both here and abroad. Sweden has made a commitment for 350 kv. Much of the guessing in this country was fixed around 330 kv as the value for early use here by the Sporn-Monteith studies at Brilliant, Ohio.

But the announced figure for the next committed step in this country is not that high. In fact, the American Gas & Electric Co has picked 300-315 kv for a projected line in West Virginia. This is just about midway between 350 kv and the 287 kv of the Hoover Dam line. Conservative engineering may have run into what might be called "admonishing returns."

The crux of higher voltage is knowledge and avoidance of the corona losses. For 380 kv these would be roughly triple what they would be for 315 kv under rain and fog conditions, other factors unchanged. Even the triple value of 15 kv per three-phase mile would hardly be excessive, however, even for a 100-mile line. Also, these losses would be incurred only during foul weather.

Interference with radio reception is another dominating factor to be considered. It is a more elusive one than corona to evaluate. Not too many data have been collected on foul weather interference, but it is known definitely that snow and rain make conditions worse. Fortunately, most of these high-voltage lines will be traversing territory where AM radio receivers are thinly dispersed.

It may well prove a wise move to study the performance of this moderately upped line before jumping into a bracket for which test data are not yet as tangible and specific as could be desired. Change later to a higher value is not difficult if provision has been made for it.

Improvement of Home Lighting

"TOO BAD that idea for home lighting promotion comes up right now. The time is not favorable. Otherwise we could go places with it. Certainly there's a lot to be done to bring lighting in the home up to the level of modernity attained by cooking, refrigeration, and all the other domestic services of electricity. But the country is moving in the direction of a war-time economy—scarcities, priorities, allocations, controls, all that. No sense in starting a sales program with a future like that ahead."

More than a few utility executives will recognize in the foregoing paragraph the kind of thinking, if any, they have given to the "Home Lighting Conditioning Program" recently announced by the General Electric Co (EW, Sept 18, p 21). It is natural that they should think that way. But it is wrong, as first thought often is.

Second thought will show that the program is aimed primarily at the promotion of an idea, with sale of products following as a consequence. At the moment there is no shortage of the products to be recommended for the improvement of home lighting. And there is no prospect of complete or even partial unavailability of the principal product that figures in the program. At no time in World War II was it even difficult for the people of this country to buy lamp bulbs. And even if bulbs and other lighting equipment were wholly unobtainable, it still would be worthwhile for the utilities to push the program. It would be worthwhile because just the correction of misapplications of light in the home would redound to their credit.

From the utilities' point of view, an unfortunate circumstance of the last war period was that, except for bills and complaints, they entirely lost touch with their residential customers. The "Home Lighting Conditioning Program" offers opportunity for the utilities to set up, under present favorable conditions, a means of friendly, personal contact with residential customers, a contact that can be maintained in continuing usefulness to both customer and utility if conditions should worsen.

Advice to Distributors Good for All

EVERYTHING POSSIBLE should be done to "hold the line on prices" to help prevent inflation.

Every effort should be made to assure fair distribution of merchandise.

Credits should be watched carefully, keeping in mind certain credit limitations imposed by the Selective Service Act as amended June 30, 1950.

Especially careful attention should be given now to service departments with reference to adequate stocks and personnel of the right age.

Effort should be made further to develop and expand engineering departments and industrial supply business.

All personnel should be classified with respect to availability as draftees or as reserves who might be called.

These are specific recommendations, in the light of present conditions, made by the executive committee of the National Association of Electrical Distributors to members of the organization. They are just plain common sense, which too often is not so common as the term implies. The NAED members are indebted to their head committee for stating and circulating such guides to sensible action in these disturbed times. So also should be all other businessmen.

Comics for Safety

GROWN-UPS vicariously get their share of chuckles out of kid-comics like Buck Rogers, Hopalong, and the rest of the supermen. But the kids take them seriously, so much so that the art looks like a good one to use as a vehicle to sell electrical safety to the school children.

Ebasco Services "took a flier" in the field and produced "Captain Marvel and the Lieutenants of Safety in Danger Flies a Kite." Utilities have passed them around in the schools, at appliance shows, through employees, and by other ways. The youngsters seize them if they are available in company offices, and schools ask for repeat stocks.

The American cartoon, comic-strip mentality may just as well be cultivated as a channel to safe play.

The Electrical Week

Britain has power for its war industries and will have no trouble doing its share in rearming the United Nations. But the ordinary citizen will be forced to use electricity sparingly until new plant comes on the line (p 78) . . . C. B. McManus, president of Georgia Power, and Richard K. Lane, president of Public Service of Oklahoma, have been appointed consultants to Interior Secretary Oscar L. Chapman. They will advise the Secretary on setting up his power controls organization (p 80) . . . The Northwest Public Power Association has passed a resolution urging Secretary Chapman to make the Bonneville Power Administration marketing agent for all federally generated energy in the Northwest (p 81) . . . Elmer L. Lindseth, president of Cleveland Electric Illuminating Co, told members of the Edison Electric Institute Accident Prevention Committee that little short of evangelical ardor will force the atention of management to safety in the face of other problems (p 82) . . . Claude Wickard, REA administrator, told delegates to a meeting of the National Rural Electric Cooperative Association that REA is on its honor to stick to its policy of making G&T loans only when a power problem must be solved or co-ops can get lower rates (p 83) . . . And higher taxes are ahead for the industry (p 84).

• • •

Seeds of possible dissention in the new controls setup already are being sown. National Production Authority's William H. Harrison has told aluminum producers that they will get power to operate at capacity all year in the Northwest where power is at a premium. But allocations of power will be made by Interior Secretary Chapman and not by Harrison who controls aluminum but not power.

Communists will be barred from employment in public utilities if the McCarran Internal Security Bill becomes law.

One candidate sure of election in November has given private power a boost. Willis Smith, the North Carolina Democrat who dumped Sen Frank Graham in the Senatorial primary, says FPC should license Virginia Electric & Power Co to build the Roanoke Rapids hydro project in northern North Carolina. The state's senior senator, Clyde R. Hoey, has taken the same stand.

By working more than 1 million hours without a disabling accident the 1,000-man Overhead Lines Department of Detroit Edison Co won a merit citation awarded by the Edison Electric Institute.

A new 10-room house on the Boston Edison Co lines has 52 separate interior circuits and 329 outlets. Remote controlled equipment, silent switches, electronically controlled garage doors, seven intercommunication units, and three TV antenna outlets are among the many features of the house.

Repetition Dept—The week that output slips below 5 billion kwhr will mark the beginning of a depression exceeding that of 1929.

The National Association of Domestic and Farm Pump Manufacturers is planning to cash in on Fire Prevention Week, Oct 8 to 14. It advises its dealers to stress that plenty of water is the best fire insurance in the world.

An employees relations program is no good unless the employees pass along the information which they receive to customers.

Institutional advertising is fine if it is backed by performance. But the advertising manager of a Southern utility reports his embarrassment the day he ran an ad praising his company's interest in its customers and three customers on the very same day reported "being kicked in the teeth" by telephone operators of the company.

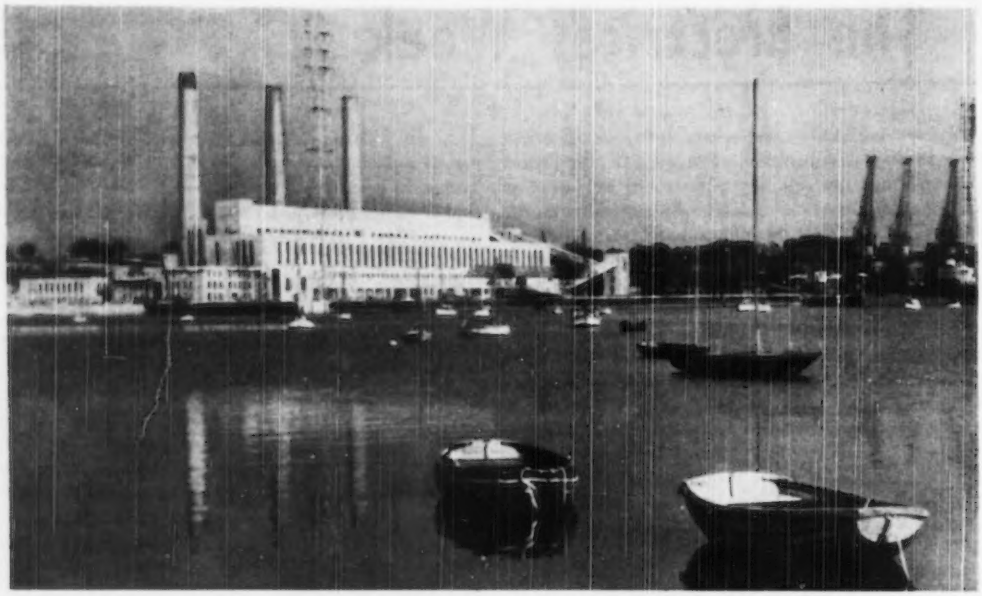
War plants and public utilities servicing them will get priority in job referrals in tight labor market areas if state-operated employment offices follow the recommendations of the U. S. Employment Service.

Toledo Edison Co was owned by 20 stockholders in the days when it was part of the Cities Service System. Today it has 68,000 stockholders.

Washington Water Power Co has the idea. It tells its employees, "Make friends and watch us grow."

Notes From The News

Cleveland Electric Illuminating Co reports that on Sept. 13 output soared to a record peak load of 846,000 kw. Power consumption gained more than 18% over the corresponding weekly period a year ago . . . Work on the main contract at the Clark Hill project in Georgia is 68% completed Area Engineer Fred W. Facey, Jr, reports. The foundation of the dam is complete and the reservoir is being filled gradually. The earth work is expected to be finished by Dec. 1.



BEAUTY of Cliff Quay Plant, Ipswich, may be due to the fact that its exterior design met the approval of the Royal Fine Arts Commission. This British Electricity Authority plant was opened last June 9 with 180,000 kw on the line. Another 90,000-kw unit will be added later

Britain Has Power for War Industries

Residential Consumers Must Continue to Sacrifice until New Plants Go on Line; Material Shortages Hamper BEA's Construction Program

(McGraw-Hill World News)

THE BRITISH ELECTRIC utility industry is ready to supply all the power needed by Britain's war industries. As the nation's rearmament program gets underway, there will be no shortage of industrial power. But for the ordinary residential consumer the outlook is not too encouraging. He may have to continue making the sacrifices that he first made some 11 years ago when the last war began.

The industrial picture is very close to that in the United States. Industries are now going full blast manufacturing civilian goods. To make more war goods civilian production must be reduced. This change would mean little to the electric industry in terms of demand or consumption of electricity. Only if working hours or shifts are increased will the electric industry feel the burden. Then the British Electricity Authority, like utilities the world over, can restrict the use of electricity by shedding load or by mandate to its customers.

Greatly retarded by the war, the British system is still unable to supply all demands being made upon it. But the effects of its construction program are beginning to be felt. There will be load-shedding again this winter, but it will be less severe and for shorter periods than in past winters.

For example, in the London and South East England area only a 10% reduction in demand will be required of

British Electric Power Statistics

TOTAL INSTALLED CAPACITY

	Jan 1, 1939	Jan 1, 1950	Jan 1, 1951*
British Electricity Authority	8,658,000 kw	13,603,567 kw	14,603,567 kw
North of Scotland Hydro-Electric Board	84,750 kw	250,970 kw	487,670

* If construction schedule is met

ENERGY PRODUCTION AND SALES

(in Million Kwhr)

	Great Britain (Excluding North of Scotland) 1939	1948	North of Scotland 1949
Total generated at stations	35,678.3	45,301.2	710.2
Sent out from stations	34,284.9	43,693.3	
Purchased from outside sources	274.0	516.5	
Total sales	31,658.0	38,354.4*	567.4**
Sales to			
Domestic users	5,794.9	13,080.4	205.6
Farms	74.6	292.5	14.9
Commercial users	3,072.3	4,368.6	102.7
Industrial users	11,221.3	18,971.5	160.0
Public Lighting	244.7	252.6	6.0
Street railways (traction)	367.1	383.4	18.8
Mainline railways (traction)	681.1	800.4	
Waterworks			2.9
British Electricity Authority			56.2

* Total BEA sales to consumers in 1949: 40,407.0 million kwhr (no breakdown available)
** Total output for public use in 1939 by the then Grampian Electricity Supply Co: 283.6 million kwhr (no breakdown available)

all industrial and commercial consumers in November between 4 and 5:30 pm and in February between 8 and 9:30 am. In December and January a 15% reduction will be required in both periods. In past years the cut has been 20%. Staggering of working hours has also been eliminated. Home consumers will again be asked to cooperate voluntarily in order to avoid the necessity of regional switch-offs.

BEA has no plans at present to increase its construction program. Instead it will stress maintenance. An increase in plant availability of 1% is roughly equivalent to the addition of two 60,000-kw units. Plant availability during the peak load of the last two winters showed a marked improvement and now represents about 90% of total capacity.

Capacity Deficit Likely

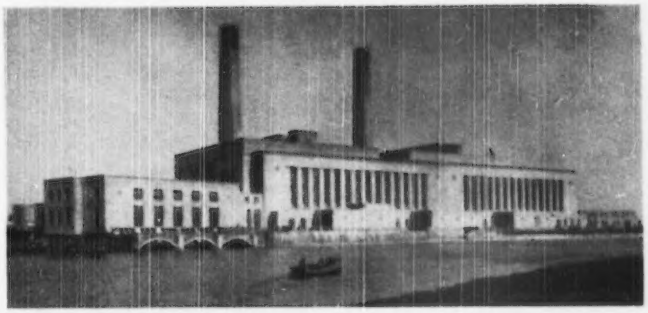
The immediate construction program of BEA calls for the installation of 1 million kw in 1950, 1.25 million in 1951, and the same amount in 1952. There may be delays in the program, but BEA has committed itself to complete these installations. That this capacity is needed can be readily understood. The authority now estimates that during the coming winter there will be a deficit of about 2 million kw in very cold weather and of about 1.5 million kw in mild weather. Since at the end of this year a total capacity of 14.6 million kw is expected, this means a deficit of nearly 14%.

In addition to BEA there is one other public supplier in Britain, the North of Scotland Hydro-Electric Board. This is a comparatively minor system. Yet, it is important in the sense that it is a supplier of energy to BEA. Any additional power coming from new Scotch plants will be available to aid the authority.

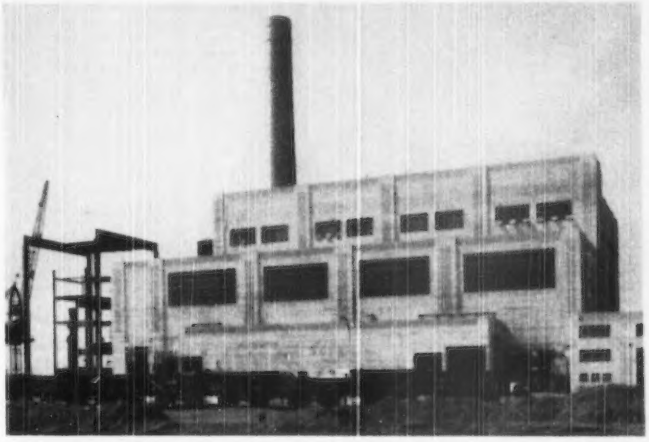
Expansion to Continue

BEA also plans to continue its big expansion program. The present long-range plans call for the installation of approximately 1.4 million kw in 1953 and about 1.5 million kw in 1954. War, or an increase in the armament program, could result in bringing about an alteration in these plans.

As in the United States, there is the problem of securing equipment. Capacity to manufacture turbines and generators is ample, but there is a shortage of boilers, pipework, and valves. BEA is trying to interest one or two large firms to enter the boiler-making field. The supply of boiler tubes is so short that some time ago the authority made arrangements to get 5,000 tons of these from Germany. Valves are being purchased in Italy. And the authority has made special arrangements with C. A. Parsons & Co to erect a pipe fabricating shop at its Newcastle works.



STAYTHORPE STATION near Newark in East Midland went into operation in August with 120,000 kw of its ultimate 360,000 kw on the line. This will be one of BEA's larger plants



LITTLEBROOK "B" at the right has a capacity of 120,000 kw. At left "C" station, which is now under construction, will have 240,000 kw. These stations are at Dartford in Kent

As a speed-up measure standardization is to get its chance. In addition to turbo-generators, the British are standardizing boiler drums and tubes, boiler capacities, and pipe and valve dimensions.

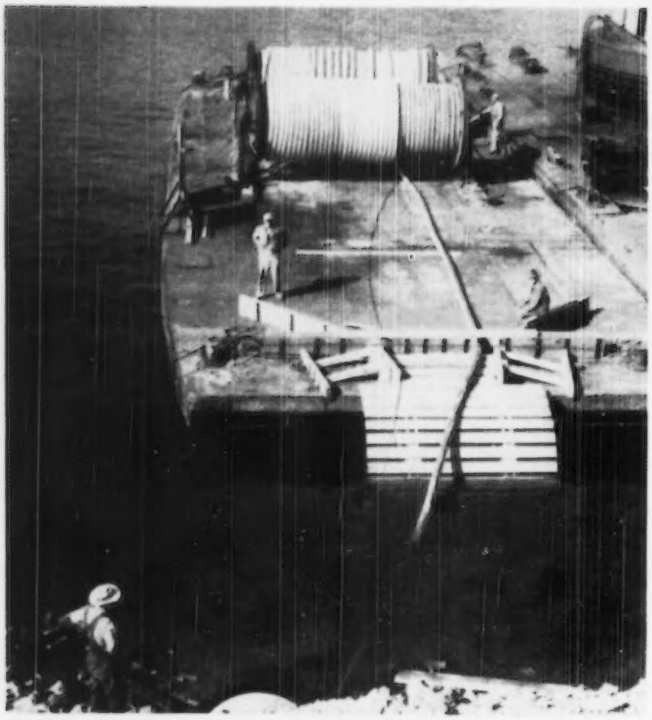
Generators are being increased in size. Most of the new units planned will have a capacity of 60,000 kw. A similar upward trend in steam pressure and temperature is evident. BEA recently put into operation the first unit operating at 900 psi at 900 deg F. A number of installations operating on a steam condition of 1,500 psi at 1,050 deg F, with a feed water temperature up to 435 deg F, are under construction.

The rising cost of fuel has led BEA to stress the improvement of thermal efficiency. While this is being done, the quality of coal has been worsening. Average consumption is now around 1.45 lb per kwhr.

Rising costs have kept the authority on its toes. Cost of new plant is considerably higher than before the war. However, the new plants use less fuel and need fewer men to operate them. A further saving is expected when a new North-South interconnection is constructed. Coal is cheaper in the North; so it will cut costs to run northern plants near their peaks at all time and move the power south. It is possible that most new plants will be erected near the coal fields so as to reduce the cost of coal whose price is very high in the South mainly because of transportation.

Further economies are expected from use of the reheat steam cycle, hydrogen cooling of generators, and the use of cyclone burners. These engineering improvements are common in the United States but reheat and cyclone burners are not used and hydrogen is used only in large units in Britain.

BEA is also installing two 15,000-kw gas turbines at Dunston and Trafford for operation in 1951.



LARGEST CABLES ever manufactured by the Okonite Co go under the Willamette River at Portland, Ore., to connect a power plant on the east side of the city with the underground system in the business district on the west side. The armored submarine cable is 5 in. in dia and weighs 31 lb per ft. Two lengths, each about 1,800 ft long, were laid simultaneously from specially designed reels mounted on a steel barge. It took less than hour to lay the cables

McManus and Lane Named to Aid Chapman Set Up Power Controls

TWO PRESIDENTS of investor-owned electric companies have been named consultants to advise Secretary of the Interior Oscar L. Chapman in setting up the machinery to administer the Department's electric power control program.

Named were C. B. McManus, president of Southern Co and of Georgia Power Co, and Richard K. Lane, president of Public Service Co of Oklahoma. Both have had experience negotiating with Chapman on federal-private power contracts.

Georgia Power is buying the output of Allatoona Dam from Interior's Southeastern Power Administration and McManus has been an outspoken advocate of cooperation with the Tennessee Valley Authority and REA-financed cooperatives. Lane negotiated the contract between Southwestern Power Administration and his own company and Oklahoma Gas & Electric Co.

McManus and Lane will help Chapman organize the power section of Interior's new Energy and Minerals Administration which will include all the Department's mobilization functions.

Power controls now are being handled on a temporary basis by an interim staff of Interior power officials. D. L. Marlett, assistant administrator of the Bonneville Power Administration, heads the Interior staff. This Power Division of EMA will be directed by a private company man upon the completion of formal organization.

Secretary Chapman is administrator of power and other controls within his department. Whether there will be a single deputy under him or one for each division of the controls agency has not been determined. Meanwhile, Alfred C. Wolf, chief of the department's program staff, is serving as Chapman's executive assistant for the new program.

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3 Ohio Edison Co Unions Strike for Pay Increase

Three locals of the Utilities Workers Union of America, CIO, have struck the Ohio Edison Co. The strike began Sept 15 in the Akron district of the company and spread to the Youngstown district and the Toronto power plant. Supervisory employees have replaced the strikers, and service has not been interrupted.

In Washington Cyrus Ching, federal mediation chief, has been meeting with representatives of the company and the union in an attempt to bring about a settlement. The company has offered a 13½¢ package. The union, which before the strike asked a 15¢ package, has raised this to 21½¢.

The territory affected by the strike represents about 75% of the area formerly served by the old Ohio Edison Co. The area served by the Ohio Public Service Co, now merged into Ohio Edison, is not affected as the workers have a contract made with OPS which extends until December 1951.

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Texas Agency Asks FPC to Rule on Jurisdiction

Backed by an appeal from Democratic Sen Tom Connally, Brazos River Conservation and Reclamation District, a Texas agency, has asked the Federal Power Commission to find that FPC licensing is not required for the construction of three proposed hydroelectric projects.

The Texas Senator criticized the growth of federal authority over the states at the opening of the hearings on the district's request. Brazos officials contended that FPC does not have jurisdiction over the projects because the dams would not affect navigation downstream. FPC staff engineers said their studies showed that the flow in the navigable portions of the stream would be decreased by the hydroelectric construction.

Following the two-day hearings which concluded Sept 14, the case is being considered by FPC presiding examiner, Edward B. Marsh.

The state agency plans to build three hydro dams—Turkey Creek, Inspiration Point, and De Cordova Bend—in Palo Pinto and Hood Counties, Texas.

The plants would have a total capacity of nearly 90,000 kva, and the project would cost $26 million.

F. FORD NORTHROP, left, Eugene, Ore., municipal system and president of the Northwest Public Power Association, confers with States R. Finley, Electric Power Board of Chattanooga and president of the American Public Power Association, at meeting of Northwest group

BPA Sought as Marketing Agency for All Federal Power in Northwest

SECRETARY OF THE INTERIOR CHAPMAN has been urged in a resolution adopted by the Northwest Public Power Association to designate the Bonneville Power Administration as marketing agency for all federally generated power north of the California, Nevada, and Utah borders and west of the Wyoming border.

The resolution, adopted at the association's semi-annual convention in Portland Sept 13-15 asked that Washington, Oregon, Idaho, and western Montana be considered as BPA's marketing area. The recommendation was based on the premise that the Bureau of Reclamation is depriving the federal government of the advantages of power pool integration by marketing power in southern Oregon and Idaho from isolated projects on an isolated, unintegrated basis.

At the same time the 267 persons present adopted resolutions opposing creation of the Snake River and Clark Fork-Kootenai river basin accounts on the ground that they would divert power revenue to subsidize high cost irrigation projects.

D. L. Marlett, assistant BPA administrator, told the group that defense committments of interruptible power made by Bonneville since July of this year had exceeded 120,000 kw. He said that during the next three years it would be possible to serve only plants capable of using interruptible power unless national defense authorities determine service for defense industries to be essential even at the risk of curtailing general service in the region.

Good and courteous service at reasonable rates is the criterion by which customers judge a service utility—not whether it is public or private, said S. R. Finley, Chattanooga Power Board. He predicted an annual consumption of 10,000 kwhr per customer on the Chattanooga system by 1955, based on his belief that there is a great area for load building in the home of today.

Adequate emergency communications and enlistment of maximum cooperation from every available source were two of the most important recommendations of a panel discussion on anticipation and repair of storm damage. Other recommendations were: establish a chain of command, with definite responsibilities; know where funds, equipment, and manpower can be obtained; have plenty of materials of all kinds on hand; repair main feeders first, disconnect laterals which cannot be immediately re-energized; have plenty of warm food and drinks on the job; discontinue night work if more than 48 hours will be required; arrange for one utility man to supervise each contractor's crew; keep the staff, press, and radio well-informed throughout the job.

Experience favors having district right-of-way men obtain tree trimming permits in advance along a line to be trimmed, reported A. E. Rotta, Pacific County PUD, in a panel discussion of preventive maintenance. He also stressed the value of cooperation with highway engineers in setting up a tree-trimming program. Robert D. Hoffman, Seattle City Light, on the same panel recommended a systematic project of pole testing covering all poles every five years.

S. E. Schultz, BPA chief engineer, was presented the Milton H. McGuire achievement award at the meeting banquet for outstanding work in engineering.

OWEN D. HURD, left, manager of the Benton County PUD and general chairman of the Engineering and Operations Section of the Northwest Public Power Association, discusses an engineering topic on the program with R. D. Hoffman of Seattle City Light Department

LOCATION of this six-room house which crowd is waiting to inspect is the lobby of the Cincinnati Gas & Electric Co. Called the "Light Conditioned" Thrift Home, the house was erected by National Homes Corp, Lafayette, Ind., a builder of prefabricated houses. The utility featured lighting equipment in the home. The *Cincinnati Enquirer* and *Good Housekeeping* magazine cooperated in sponsoring a "Good Lighting Is Good Housekeeping" contest to select "good housekeepers of the day." Display was a feature of National Home Week

Evangelical Ardor Urged to Rouse Executives to Importance of Safety

LITTLE STORY of evangelical ardor on the part of safety directors will command executive attention to safety in the face of other problems absorbing the interest of management. This was the message of Elmer L. Lindseth, president of the Cleveland Electric Illuminating Co, to the EEI Accident Prevention Committee meeting in his city Sept 11 and 12.

He stressed the fact that 27 other industries have a lower accident frequency record and 35 a better severity record than the electric utilities, proposing a goal of 50% improvement for the fourth quarter of 1950 to bring the year's performance to the general average of all industry.

Someone, said Lindseth, must rouse top management to a realization of the seriousness of the cold statistics. More dramatization is needed to impress top executives so that the better-record companies can say, "You can't do this to our industry" to those with the poorer records. Safety men must "muscle in" for recognition. His conclusion was that those statistics and the relative standing of the utility industry are a blot on all in it until the bad record is pared down.

Lindseth's fervor hit the 50 in attendance with such impact that Chairman W. T. Rogers of Ebasco Services laid aside the morning agenda to allow the group time to work out means to achieve the recommended objective. One company president reportedly had said, "Tell all my vice presidents and department heads what you safety men want them to do and I'll be asking them a year hence why they didn't do it." Several recommended that safety should sit closer to top councils. One member said much of the present admitted weakness lies in the supervisors who have not been instructed specifically on their responsibility and enforcement authority. Others urged more publicity on awards to companies for meritorious accident records.

For the first six months of 1950 the showing of 19 fatalities in 32 member companies is 12% worse than for the six 1949 months but the total record of 1,178 injuries (including permanent partial and temporary total) represents a 21% improvement. H. J. Crisick of CEICO reported. In 1949 the industry total of 134 electric shock or burn fatalities was 76% of the 176 total, 5% above the nine-year average, according to D. C. Stewart of Niagara Mohawk Power Corp. Stewart estimated that total economic loss to families and utilities is $20 million to $40 million.

Round table discussion disclosed that five utilities using 18-in. gloves found, in general, a higher failure rate on test-inspection unless the leather protectors used with standard 14-15-in. gloves were correspondingly extended. Twenty companies use rubber sleeves but only seven make the use mandatory; of the 20 eighteen prescribe shoulder length.

Discussion of aluminum derricks was not at all favorable; only three utilities said they used them. Consolidated Edison Co of New York reported experimentation with a paint-removing caustic that is relatively harmless to human skin.

Utility vehicle fatalities are on the increase and several companies are intensifying their driving tests and schools. One member raised the question of whether antihistamines produce dangerous drowsiness. Another said road glare will do it but there are glasses and goggles for correction.

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Inventory Controls Put on Goods in Short Supply

Inventory controls covering 32 materials in "short supply" were ordered Sept 18 by the Department of Commerce's new National Production Authority.

Stated only in general terms, the new inventory restrictions did not specify limitations on inventories beyond a "practical minimum working inventory." This the order defined as being the "smallest quantity of material from which a person can reasonably meet his deliveries or supply his services on the basis of his currently scheduled method and rate of operation."

Both copper and aluminum were on the list of materials, with wire among a wide variety of forms of these metals included under the new NPA Reg 1. Also on the list were certain other metals and minerals, iron and steel, rubber, Portland cement, several chemicals, and most lumber.

Only normal inventory records are required by the regulation, but NPA can require reports and inspect and audit inventory records.

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To Install 60,000-Kw Unit

Gulf States Utilities Co will install a 60,000-kw generator at its Nesches Plant, Beaumont, Texas. The addition will increase the plant's capacity to 245,000 kw.

GUEST SPEAKERS at annual meeting of Region IX of the National Rural Electric Cooperative Association were Claude R. Wickard, left, administrator of the Rural Electrification Administration, and Dr Paul J. Raver, Bonneville Power Administrator

REA On Honor to Obey the Law on G&T Loans

The REA has been put upon its honor to adhere strictly to its announced policy and the law in making loans for generation and transmission facilities, according to REA Administrator Claude Wickard. This policy, in his own words, "calls for making loans for generation and transmission facilities only when such facilities will solve a power problem or bring about an economy in the wholesale power cost to cooperatives."

Speaking before some 200 attending the Region IX annual meeting of the National Rural Electric Cooperative Association in Portland, Sept. 11-12, he interpreted the recent Senate committee report embodying this statement as "explicit" and an approval of present REA policy on generation and transmission loans. He warned the group that if the evidence should indicate that REA is not carefully adhering to the policy, Congress might be convinced that some other agency or method should be tried. This, he said, would be disastrous to the cooperatives and therefore should be avoided.

He also indicated that the purse strings would be pulled tighter as a result of national defense activities. REA will limit financing of consumer facilities to those essential to welfare of rural families and to efficient farming, and will approve loans for headquarters buildings only in cases where no other adequate facilities are available.

Paul J. Raver, administrator of Bonneville Power Administration, warned the group that the Pacific Northwest is in no position to make major contributions to the defense program as it was in 1940. Projects under construction in the area are inadequate to meet normal growth requirements, he said, and certainly cannot take care of any substantial industrial expansion. He urged immediate approval of the Ice Harbor and Hell's Canyon projects (Ice Harbor was coincidentally approved by the Senate the following day), toward the end that the region should have a margin for the national security program at least equal to the 2 million kw of 1940-1945.

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Federal Power Agencies Face Slash in Funds

Federal power agencies—but not federal power projects—are scheduled to share in the $550 million slash being made in the $36 billion appropriations bill which provides funds for government operations during the current fiscal year.

The cutback in non-military spending is being directed by the Bureau of the Budget. Thus far, the Army Corps of Engineers has been put down for a $50 million drop, while Reclamation is slated to lose $45 million. However, both the Corps and the Bureau have announced that cuts will be made in non-power projects.

One major cutback in federal power funds may be in the Rural Electrification Administration's loan program. The Agriculture Department has been ordered to reduce loan programs by $100 million, and some of this sum will come from REA's electrification and telephone funds. Just how much of this reduction will be borne by REA has not been decided.

1st Workshop Conference of PIP Held at Chicago

A workshop conference, a practical school for those who handle the public and employee relations of their companies, was conducted by the Electric Companies Public Information Program, Sept 14-15, at Chicago. Approximately 160 men representing companies from all sections of the United States were present. This was the first such conference conducted by PIP.

Representatives of 33 companies took part in the 11 panels which formed the main portion of the program. Some of these panel topics were "Coordination of Advertising and Public Relations," "Informational Activities for Civic and Other Organized Groups," "Enlisting the Support of Stockholders," "Channels of Communication from and to Employees," "What Employees Want to Know about Their Company and Industry," and "Use of Contact Employees in Public Relations."

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EEI Prepares Forms for Lighting Salesmen

Edison Electric Institute has prepared a Planned Lighting Layout Form as an aid to lighting analysis. It provides lighting engineers and salesmen with a complete, convenient method for making layouts of lighting installations.

The form provides space for a complete installation analysis. It includes a lighting calculation page, space for a recommendation record, and a two-page, cross-ruled sheet for indicating the position of the various lighting fixtures.

Also available are gummed stickers showing different types of fixtures used in commercial and industrial lighting. The sticker showing the recommended type of fixture easily can be attached to the space on the form provided for making recommendations.

EEI, in addition, has prepared three insert sheets which give selling points for customers in store, office, and industrial lighting fields.

Prices of layout forms, insert sheets, and drawings of the fixtures can be obtained from EEI. Orders should be addressed to Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

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Utility Increases Wages

Scranton Electric Co has signed a contract with Local 265, Utility Workers Union of America, providing for a wage of 6.1¢ an hour retroactive to July 1. The agreement, covering 170 workers, also grants an improved pension plan.

YIELDS (%)—Operating Electric Utility Securities

Quality	Bonds 1st	Bonds 2nd	Bonds 3rd	Preferred Stocks 1st	Preferred Stocks 2nd	Preferred Stocks 3rd	Common Stocks 1st	Common Stocks 2nd	Common Stocks 3rd
DATE									
1950									
Sept. 14	2.65	2.67	2.73	3.80	4.06	4.45	5.79	6.71	7.56
Sept. 7	2.61	2.64	2.72	3.80	4.05	4.44	5.77	6.71	7.53
END OF QTR.									
3rd 1950	2.68	2.66	2.74	3.79	4.03	4.38	5.38	6.51	7.50
1st 1950	2.59	2.61	2.74	3.78	4.01	4.36	5.22	5.85	6.67
4th 1949	2.59	2.61	2.72	3.85	4.06	4.46	5.37	6.15	7.01
3rd 1949	2.61	2.65	2.77	3.88	4.15	4.54	5.55	4.67	7.51

Data: Reis & Chandler, Inc.

Corporate Income Tax of 45% Set; Excess Profits Levy Slated for 1951

NOW THAT the stop-gap tax bill is out of the way Congressional tax writers are turning to next year's revenue legislation. All told, the two bills probably will cost taxpayers about $12 billion.

The bill just passed is scheduled to bring in $4½ billion, roughly half from business, the rest from individuals. Effective date: Oct 1.

Corporations will pay a normal tax of 25% on all income plus a surtax of 20% on income above $25,000. These rates apply to tax years beginning after last June 30. If the company's tax year began before June 30, it can use an alternative rate of 23% normal and 19% surtax. Accelerated amortization will provide some relief for a few firms. Companies that expand or build plants for rearmament may write off certified emergency facilities within a five-year period.

The Mills Plan to make corporations pay taxes early in the year will start gradually in 1951. That year they will owe 60% of their tax in the first half; in 1952, 70%; and so on.

The law cracks down on some loopholes, eases up on others. For example, it taxes business income of educational and charitable trusts and investment income of insurance companies but exempts transfers of assets from an existing corporation to a new one under the same ownership.

The bill that Congress is going to pass next spring—though consideration may start this November—probably will cost taxpayers more than $7 billion.

Bulk of the money will come from an excess profits tax. The President asked for one, and both houses have gone on record in favor of a levy that would be retroactive for part of 1950.

As yet there has been no word from the White House or Treasury on details. But chances are that any new scheme will resemble the last war's in general outline.

The base computation on average earnings is sure to include two or all three of the years 1947-49. But there will be some deflation. In other words, businessmen will be able to use, say, 90% of postwar earnings as a yardstick in computing normal earnings. There certainly will be an exemption for all corporations, probably more than the last war's $10,000—about $20,000 or $25,000 seems in the cards.

Invested capital also will be an acceptable base. Normal profits will be computed at 5-8% of original investment.

The actual rate of tax on excess profits probably won't go up to the World War II peak of 95% right away.

Corporations face the possibility of income tax rates above 45%—and maybe some more loophole-plugging. Sentiment for increased excises or a sales tax—or even penalty taxes for the purchase of, say, automobiles—is gaining strength.

NARUC Plans to Oppose Excess Profits Taxes

Excess profits tax proposals covering utility earnings will be fought by the National Association of Railroad and Utilities Commissioners.

The NARUC's executive committee, meeting in Chicago Sept 14, formally established a committee on excess profits taxes. The committee's job: Prepare a presentation for Congressional committees considering tax legislation to show how excess profits taxes on utilities impair effective regulation and how they affect rate payers.

Commissioners appointed to the new tax committee are Justus F. Craemer, California, chairman; Wade O. Martin, Louisiana; B. Frank Morgal, Pennsylvania; Owen Clarke, Washington; Charles E. Anderson, West Virginia; John Hessy, Maryland; and H. Lester Hooker, Virginia. Pres Harry Miller, Ohio, and General Solicitor Walter R. McDonald, Georgia, will serve as ex officio members.

Another new NARUC committee was established to deal with defense mobilization. This group will cooperate with federal control agencies in dealing with problems of regulated business. Members of the committee have not yet been named.

FINANCIAL BRIEFS

American Power & Light Co stockholder H. Lane Ogle, Stamford, Conn., has filed a new petition with the Securities and Exchange Commission calling for dissolution of the holding company. Ogle was one of the stockholders who last June asked for hearings before an SEC examiner on dissolution of American. SEC has not acted on the earlier request.

Electric Utility Financing—September 9-16

Company	Description	Amount of Offering (000)	Offering Price	Yield at Price to Public
Bonds				
Virginia Electric & Power	2¾% Series H 1980 new money	$20,000	100.75%	2.71%
Preferred Stock				
Duquesne Light	150,000 sh $50 par new money	7,650	$51.00	3.68
Common Stock				
Utah Power & Light	166,604 sh new money	4,040	24.25	

Exchange Offer

Consumers Power—106,200 shares of common stock will be exchanged for 236,000 shares of common stock of Michigan Public Service at the rate of 45 shares of Consumers for 100 shares of Michigan Public Service. Purchase of the assets of Michigan Public Service was completed Sept 8.

SCHEDULED

Bonds—Cleveland Electric Illuminating, first mortgage 1985, new money, $25 million; New Hampshire Electric, first mortgage 1975, to retire $1,250,000 notes payable to banks due Dec 31, 1952, and $1,880,000 (before call premium) mortgage bonds, $3.6 million.

Common Stock—Central Maine Power, 260,000 sh, holding company divestment, $4 million; Pacific Power & Light, 1,750,000 shares by selling stockholders, $26 million; Louisville Gas & Electric, 137,857 shares, holding company divestment.

Columbus Voters to Ballot on 22% Rate Reduction

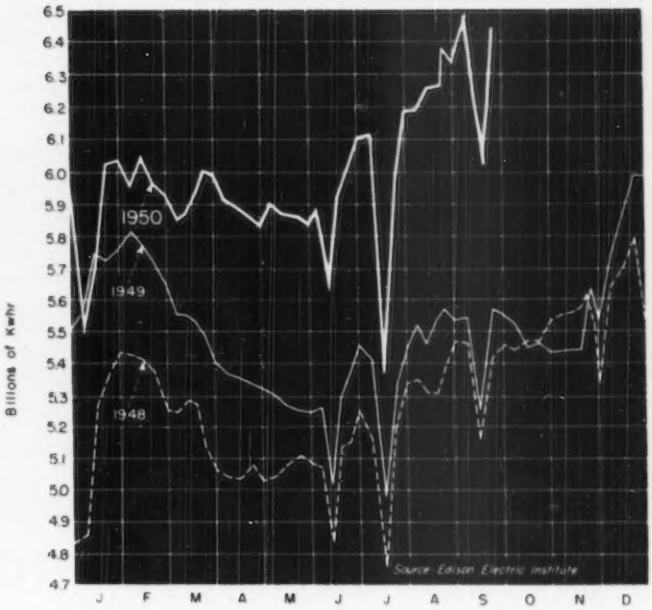
Columbus, Ohio, voters will ballot Nov 7 on a 22% cut in electric rates that would end a year-long controversy between the city council and Columbus & Southern Ohio Electric Co.

The utility and the council have reached agreement on a new rate schedule calling for residential payment of $3.50 for the first 100 kwhr, almost 22% below the present charge of $4.47. The present rate includes a 6.4% surcharge levied by the utility to cover increased operating costs.

The new rates would go into effect Nov 15 and be retroactive to Nov 15, 1949. Refund of about $1,075,000 would be made to 89,000 Columbus domestic users starting next summer. Surcharges and delayed payment charges would be eliminated. The agreement also fixes rates for small commercial consumers but not for large commercial and industrial users.

Cost to the utility in the three years for which the agreement would run would be about $4 million. The rate schedule may be extended in 1951 and again in 1954. The new rates would be the lowest in the city's history and among the lowest in the state.

The agreement ends litigation before the Ohio Public Utilities Commission that began a year ago. When negotiations between the city and the utility reached a deadlock, the council ordered a 27% rate reduction. Columbus & Southern Ohio appealed to the PUC.



Output Week Ended Sept 16—6,449,101,000 Kwhr

Weekly Output, Millions Kwhr

1950	1949	1948
Sept 16 6,449	Sept 17 5,579	Sept 18 5,426
Sept 9 6,029	Sept 10 5,258	Sept 11 5,166
Sept 2 6,459	Sept 3 5,544	Sept 4 5,470
Aug 26 6,346	Aug 27 5,523	Aug 28 5,478
Aug 19 6,370	Aug 20 5,579	Aug 21 5,391
Aug 12 6,253	Aug 13 5,530	Aug 14 5,318
Aug 5 6,247	Aug 6 5,466	Aug 7 5,319
July 29 6,190	July 30 5,518	July 31 5,352
July 22 6,186	July 23 5,462	July 24 5,342
July 15 6,006	July 16 5,142	July 17 5,197

Percent Change from Previous Year

	Sept 16	Sept 9	Sept 2
New England	+14.4	+14.9	+17.0
Mid-Atlantic	+14.9	+14.9	+16.9
Central Industrial	+18.5	+18.2	+20.9
West Central	+13.9	+11.5	+13.3
Southeast	+16.3	+17.8	+18.9
South Central	+15.5	+ 8.9	+18.7
Rocky Mountain	+19.0	+12.0	+15.5
Pacific Coast	+11.3	+10.3	+ 7.6
Total United States	+15.6	+14.7	+16.5

MEETINGS

International Association of Electrical Inspectors
Eastern Section, Hotel Statler, Buffalo, N. Y., September 25-27; Western Section, Book-Cadillac Hotel, Detroit, Mich., October 2-4; Southern Section, Hotel Sheraton Plaza, Daytona Beach, Fla., October 16-18.

National Electronics Conference
Edgewater Beach Hotel, Chicago, Ill., September 25-27.

Canadian Electrical Manufacturers Association
Annual Meeting, General Brock Hotel, Niagara Falls, Ontario, Can., September 27-29.

Association of Edison Illuminating Companies
Annual Meeting, Broadmoor Hotel, Colorado Springs, Colo., September 27-30.

Southeastern Electric Exchange
Engineering and Operations Conference, Henry Grady Hotel, Atlanta, Ga., September 28-29; Sales Conference, Biltmore Hotel, Atlanta, Ga., October 25-27.

National Television and Electrical Living Show
Chicago Coliseum, Chicago, September 29-October 8.

Edison Electric Institute
Prime Movers Committee, Copley Plaza Hotel, Boston, October 2-3; Electric Equipment Committee, Chamberlain Hotel, Old Point Comfort, Va., October 9-10; Transmission and Distribution Committee, Hotel New Yorker, New York, October 19-20; Meter and Service Committee, Robert Treat Hotel, Newark, N. J., October 25-27; Industrial Relations Committee, Netherlands Plaza Hotel, Cincinnati, Ohio, November 13-16.

American Institute of Electrical Engineers
Middle Eastern District Meeting, Lord Baltimore Hotel, Baltimore, Md., October 3-5; Fall General Meeting, Skirvin Hotel, Oklahoma City, Okla., October 23-27.

★**Pennsylvania Electric Association**
Transmission and Distribution Committee, Irem Temple Country Club, Dallas, Pa., October 5-6; Electrical Equipment Committee, Roosevelt Hotel, Pittsburgh, Pa., October 19-20; Prime Movers Committee, Benjamin Franklin Hotel, Philadelphia, November 2-3; Meter Committee, William Penn Hotel, Pittsburgh, Pa., November 9-10.

Rocky Mountain Electrical League
Annual Convention, Broadmoor Hotel, Colorado Springs, Colo., October 7-11.

Interstate Power Club of New York
Hotel Martinique, New York, October 9.

Indiana Electric Association
Annual Convention, French Lick Springs Hotel, French Lick, Ind., October 11-13.

International Association of Electrical Leagues
Annual Conference, Copley Plaza Hotel, Boston, Mass., October 11-14.

International Brotherhood of Electrical Workers, AFL
Convention, McAllister Hotel, Miami, Fla., October 16.

Iowa Utilities Association
Management Conference, Fort Des Moines Hotel, Des Moines, Iowa, October 16-17.

National Electrical Contractors Association
Annual Convention, Hotel Biltmore, Los Angeles, Calif., October 17-20.

National Farm Electrification Conference
Melbourne Hotel, St. Louis, Mo., October 18-20.

Pacific Coast Electrical Association
Operating Economic Section, Whitcomb Hotel, San Francisco, Cal., November 2; Business Development Section, California Hotel, Fresno, Cal., November 9.

Wisconsin Utilities Association
Electric and Gas Section, Schroeder Hotel, Milwaukee, Wis., November 8-10.

National Electrical Manufacturers Association
Chalfonte-Haddon Hall, Atlantic City, N. J., November 13-16.

New Jersey Utilities Association
Annual Meeting, Seaview Country Club, Absecon, N. J., November 17-18.

★ Addition this week.

Donate Lights for Field

Twenty Appalachian Electric Power Co employees donated their time and money to make it possible for Williamson, W. Va., high school fans to "see" night football games. The workers chipped in $3,000 and their services to install 120 lights. Poor lighting of the field had made it difficult to see the game.

WASHINGTON COMMENT

RONALD D. ROSS

RURAL ELECTRIFICATION Administrator Claude R. Wickard recently announced a couple of "program adjustments in view of national defense" which raise some interesting questions.

The two new REA emergency loan rules are good—so far as they go. As a matter of fact, they are so meritorious that they might well be made permanent rules to apply at all times regardless of defense needs or war tension.

First, Administrator Wickard has told REA borrowers that loans for headquarters buildings will be made "only in cases where no other adequate facilities are available. In cases where loans are made for this purpose it will be essential that all headquarters buildings be as economical as the system's needs permit."

This is certainly praiseworthy, but it need not be just an emergency measure. Should taxpayers' money be loaned to co-ops for headquarters buildings when there are other adequate facilities available? Why should federal funds be granted at 2% interest for co-op headquarters which are not "as economical as the system's needs permit?" The answers to these questions are a part of the basic problem of whether REA loans are intended to finance new electric systems—to supplement, complement, or compete with the private utilities—or whether they are to be made only for the purpose of expanding electric service to farms.

There is a clear implication in the new REA regulation that the agency's funds have been loaned for unnecessary or uneconomical headquarters buildings for co-ops. This could and should be stopped by making the new rule a permanent fixture rather than a defense measure.

The second new "restrictive policy" will "limit the financing of consumer facilities to those which are essential to the welfare of rural families or to efficient farming."

About all that this precludes is loans made to finance radios, electric toasters, waffle irons, and the like. Specifically exempted from the new limitation are a wide variety of appliances and electrical equipment: Electrical farm equipment; water systems and plumbing; food preparation or preservation equipment; laundry, cleaning, and sewing equipment; and wiring, lighting, and fixtures.

Loans for these items are made under Section 5 of the Rural Electrification Act, and even REA officials have not always been very happy about this federal financing for co-ops in the appliance and equipment business. The new restriction does not put any major crimp in this sort of operation, but it suggests a problem which Congress ought to reconsider. Amendment of Section 5 of the REA Act is needed if this encroachment on private business enterprise is to be curtailed. Meanwhile, however, the new ruling is a healthy development—as a matter of normal policy rather than a mere emergency step.

REA officials have made no estimate as to how much the new restriction might save in a year in loan funds, or even how much of the funds loaned last year went for these curtailed purposes. It's certain, though, that the sums would be small in a loan program that has been authorized for as much as half a billion dollars during the current fiscal year. And it's certain, too, that there are other ways in which real savings can be made in the REA program.

Multi-million dollar loans for generating and transmission facilities have little to recommend them as defense measures. They take federal dollars needed to pay for war equipment, and they compete with the private utility industry not only for customers but also for equipment and materials. Putting a formal halt to "g & t" loans now would conserve both dollars and materials for the defense effort.

The new restrictions are only a beginning in the "program adjustments" REA should make "in view of national defense."

TECHNICAL NOTES

ARCHER E. KNOWLTON

Sapphire jewels for pivot-type watthour meter bearings will wear longer if cut so that the optic axis of the crystal lies at right angles to the axis of revolution of the pivot recess.

Several ceramics have higher ratios of tensile strength to density than the better commercial alloys at 1,500-2,200 F; that is of significance for gas turbines, especially the stator blades.

Ropes of spring-lay type in storage can be preserved by a dressing composed of four parts of liquid pine tar and one part liquid coal tar to three parts of shellac varnish. The Bureau of Ships USN calls it Paint Formula 118.

Entrained air promotes workability of concretes with light weight aggregates and density $\frac{1}{3}$ to $\frac{3}{4}$ that of sand-gravel concretes. The former has very low thermal conductivity but little strength.

A self-regulating distribution transformer without moving parts is something to keep on dreaming about. It would resolve much of the problem of voltage maintenance.

Some residual fuel oils produce more ash and slag-forming material than low-grade coals and require a different approach in combustion space design.

Clamshell buckets have been used successfully to clean out forebays and tail races without lowering the water.

WATER PUMPED UP from Inks Reservoir (in foreground) to Buchanan Reservoir during off-peak periods, using energy from steam-generated power to run 13,450-hp motor and pump, operates hydro generators at Buchanan Dam during peak-load periods

Pumped-Storage Gives Buchanan Dam Low-Cost Peaking Capacity

Water pumped from lower to higher reservoir during off-peak periods by steam-generated energy provides needed peaking power for low load factor operation at minimum cost

G. E. SCHMITT, Asst General Manager and Chief Engineer
Lower Colorado River Authority, Austin, Texas

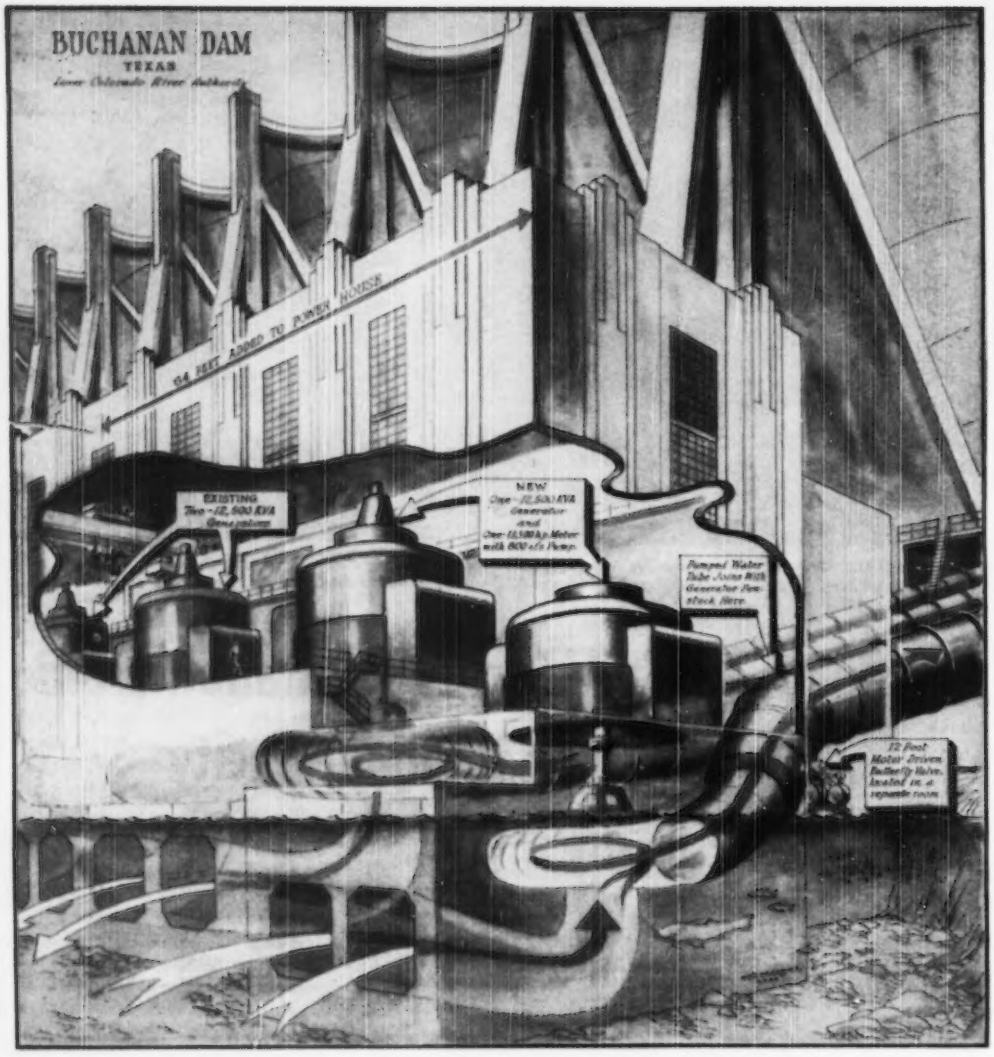
ONE of the first applications* in the U. S. of the pumped-storage principle of obtaining peaking capacity, is now nearing completion at Buchanan Dam of the Lower Colorado River Authority. When completed the installation will insure a big enough water supply so that all units at the dam can operate at maximum capability during heavy load periods throughout dry seasons. To do this a 13,450-hp motor and centrifugal pump, which operates on off-peak power supplied by steam units, returns water from Inks Reservoir, formed by Inks Dam, three miles downstream, to the higher-elevation Buchanan Reservoir.

Decision to provide additional generation through the installation of a pumped storage system was influenced by several important factors. Among them were:

1. When Buchanan Dam was constructed provision was made for the future installation of a third generator and turbine. The head gate tower was constructed and a short section of penstock, 12 ft in diameter, was installed. Buchanan Dam was started by private interests in 1928, but was abandoned during the depression. The LCRA completed the dam in 1938. Provisions for a third unit were made because of original plans to construct a flood-control hydroelectric dam upstream from Buchanan which would have guaranteed dry-year operation at all three units.

2. Since Buchanan Reservior has a storage capacity of 1,000,000 acre-ft, stream flow records revealed that three-unit operation would be possible without pump operation during the wet cycles but that insufficient inflow was available during dry years to permit three-unit operation without jeopardizing the capability of the plant unless water was returned to the reservoir during off-peak hours by pump operations.

* Pioneer pumped storage plant in U. S. is Rocky River Plant of Connecticut Light & Power Co placed in operation in 1928. See ELECTRICAL WORLD May 12, 1928.



DURING OFF PEAK HOURS water is pumped up penstock at right for use during peak load periods. One leg of "Y" of third penstock goes to No. 3 generator, the other to the pump. Pump motor can be operated during peak period as synchronous condenser

3. An abundant water supply for pump operation is assured since the normal elevation of Inks Reservoir is the same as the normal tail water elevation at Buchanan. Thirty hours of continuous pump operation will create only a 2-ft drawdown of Inks Lake, but will add sufficient water in Buchanan to operate the third generator for 20 hr.

4. An abundant supply of off-peak energy from the Authority's steam plant and from other steam plants operating in the interconnected system will be available for pumping water.

5. The fact that no appreciable increase in personnel would be required to operate the proposed additional facilities.

Basic Principles . . . Principles employed in the installation are fundamentals that are well known. Power and energy will be generated by a hydro-electric unit similar to modern hydro plants. The process of lifting large quantities of water from one elevation to another by means of high efficiency centrifugal pumps driven by large electric motors employs the same fundamental principles whether such purposes be for pumped storage, for irrigation of farm land or for domestic use.

This basic principle is used in one other installation in this country and on several in foreign countries where the operations were designed

to transfer water from one river to another to obtain higher heads for hydro generation.

Design, Installation and Cost . . . In the Buchanan installation, a high over-all efficiency was desired, and this resulted in the installation of a pump and motor separate from the turbine and generator.

The third penstock was connected to the section originally installed and was tied into a "Y" connection. One leg of this "Y" goes to a motor-operated butterfly valve and thence to the pump. The other leg of the "Y" connects to the turbine of the third generating unit as shown in the accompanying cut-away drawing on the page opposite.

The motor-operated valve is connected to proper relays and protective equipment to close within two minutes in case of power failure. This valve also isolates the pump from the penstock during the time the generator is in use to permit customary hydro operation.

Rating of the third generator is 14,375 kva and the turbine is capable of producing 14,000 kw at the generator terminals under normal head. The two original generators and turbines at the dam have the same output rating.

Pump motor rating is 13,450 hp, 80% power factor leading, 6,900 v, 164 rpm. Runaway speed in reverse is limited to 210 rpm.

Capacity of the pump is not less than 804 cfs when operating at 120-ft head. Overall efficiency at the power house of the generator and pumping units is expected to be better than 70%.

Total cost of the third generator and pumped storage installation is estimated to be approximately $115 per kw based on the capability of the generator.

Starting Pump . . . In order to start the pumping cycle, the motor will be started manually by first closing the motor and generator breakers and then applying normal field current on both units supplied from two motor-generator sets. Torque applied to the generator shaft by means of water going through the turbine will accelerate the motor to normal speed by the synchronous torque developed. After synchronous speed has been reached, the two units will be connected to the remainder of the system and load applied to the motor by allowing water to enter the intake side of the pump and then opening the butterfly valve. The generator used in starting the motor will then be shut down as power and energy requirements for pumping will be fed from stream electric generating plants of LCRA and interconnected companies.

THE THREE PENSTOCKS looking toward the power house from the dam. The one at left connects with "Y" just beyond the concrete wall. One leg of "Y" goes to No. 3 turbogenerator; other, to motor and pump. Building at right is elevator house

While the Buchanan installation fits a particular situation, it is not offered as a cure-all for all hydro installations where additional capacity is desired and insufficient water supply exists; however, it is believed that there are many locations in the nation where similar installations would soon prove to be quite practicable.

Cost of the recently announced reversible pump-turbine unit should be considerably lower than the two-unit installation. In the Buchanan installation another advantage obtained by installing the pump and motor separate from the generator is the possibility of operating the pump motor as a synchronous condenser during peak load hours if and when reactive conditions require it. By closing the butterfly valve and continually depressing the water in the pump by air, the motor should operate with fair efficiency as a synchronous condenser.

Present System and Requirements . . . The Lower Colorado River Authority, an Agency of the State of Texas, owns and operates a series of multi-purpose dams and reservoirs on the Colorado River, a stream characterized by wide variations in water supply from short-term floods to prolonged periods of drought.

The Authority supplies, under long-term contracts, the total power and energy requirements of thirty-three municipalities and eleven rural electrification cooperatives located in a 31,000-sq-mile area in Central Texas. In addition, the Authority, under long-term contracts, supplies power and energy for peaking and emergency purposes to six major steam-electric generating systems who are, in turn, interconnected with other major electric power companies in the state.

The Authority owns and operates four major dams and hydro-electric plants on the Colorado, and operates six smaller dams on neighboring streams with a total capacity of 150,000 kw in hydro-electric generating equipment. It also operates a 60,000-kw steam plant at New Braunfels, Texas. Approximately 50% of this 210,000-kw capacity is used to supply requirements having 50 to 60% load factor, and the balance is used to supply energy to low load factor customers who are interconnected.

Load Factor Studies . . . On the basis of projected load curves, it was determined that additional equipment would be utilized at a low annual load factor ranging between 20 and 25%. It was evident from these studies that hydro-generation was not only the most economical, but also the more desirable from an operating view point.

A companion problem was to provide such additional equipment within a limited period, and at a reasonable installation and operating cost. This was particularly important in view of the fact that the Authority is not supported by either state or federal appropriations, but must pay operating costs out of revenues and must finance physical expansions through the sale of interest-bearing revenue bonds.

Neutral vs Corner-of-the-Delta Grounding

W. F. STRONG, Industrial Power Division
General Electric Co, Schenectady, N. Y.

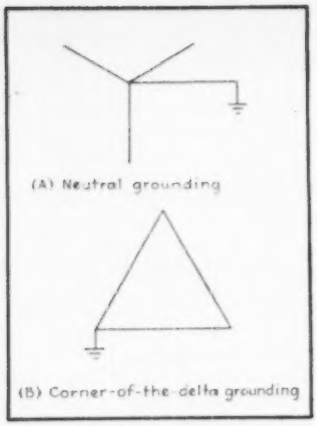


FIG 1—TWO METHODS of grounding a power system in industrial plants

For industrial power systems neutral grounding offers advantages over corner-of-the-delta. The author tells what they are and why they are important

ELECTRICAL ENGINEERING IN INDUSTRY

THE modern trend in industrial plants is to operate the power system with the neutral grounded. This applies to all voltage levels—from 120-v lighting circuits to 13.8-kv distribution systems. In the case of low voltage systems (120-600 v), it is sometimes considered desirable to ground one phase rather than the system neutral as illustrated in Fig 1. The purpose of this article is to examine the characteristics of so-called "corner-of-the-delta" grounding and to indicate the preferred practice for industrial systems.

Providing a Neutral . . . Formerly, many standard unit substations were provided only with delta-connected transformer secondaries. To obtain the advantages of grounding, and since the system neutral was not available, it was advocated that one phase of the secondary be grounded. However, this has been changed to the extent that now, standard load-center unit substations are equally readily available with either delta or wye-connected secondaries in all standard kva ratings.

In existing delta-connected systems, a zig-zag type grounding transformer may be used to establish a neutral as shown in Fig 2.

Advantages of Neutral Grounding . . . There are five advantages of neutral grounding:

1. It is not necessary to carefully identify each phase of the system. In corner-of-the-delta grounding, the grounded phase must be set apart by suitable marking throughout the system to insure that important instruments, meters and overload relays will not be connected in this phase. This point is illustrated in Fig 3. If a ground fault occurs on phase A (the grounded phase) of the left-hand feeder as shown, part of the normal load current of this circuit will flow through the ground path, by-passing the current transformer. Thus, the ammeter and watthour meter will have incorrect readings. The correct method is shown on the right-hand feeder of Fig 3.

An Illustration . . . The extent to which damage can result from improper phasing is shown in Fig 4. In this case, a ground fault first occurred on phase A. It may remain undetected for months or years. During this period, if a second ground fault occurs, as shown on phase C, fuse C may blow; whereas, fuse A may remain intact due to the shunting effect of the first ground. The motor will now operate on single-phase power. Since the only overload element remaining is also by-passed, it will not provide adequate protection and the motor may fail due to overheating. This is an unusual case but illustrates some of the occurrences which can be expected.

2. In a neutral-grounded system the maximum line-to-ground voltage is 58% of the line-to-line voltage as shown in Fig 5A. In a system having one phase permanently grounded, the two ungrounded phases are line-to-line voltage above ground as shown in Fig 5B. This represents an increased hazard to personnel and a somewhat increased possibility of ground faults due to the higher insulation stress.

3. In a corner-of-the-delta grounded system, a motor starter control circuit may be connected to the grounded phase in such a manner that a ground fault in the control circuit will not accidentally start the motor. (This is illustrated in Fig 6.) This characteristic is sometimes offered as a principal advantage of corner-of-the-delta grounding. However, this connection should not be relied on to prevent accidental motor starting since there are other causes of such an event. For example, unauthorized personnel may operate a "start" button at the wrong time. Thus, whenever there is a hazard to personnel or equipment for a motor to start accidentally, it should be standard practice to open the line switch on either method of grounding.

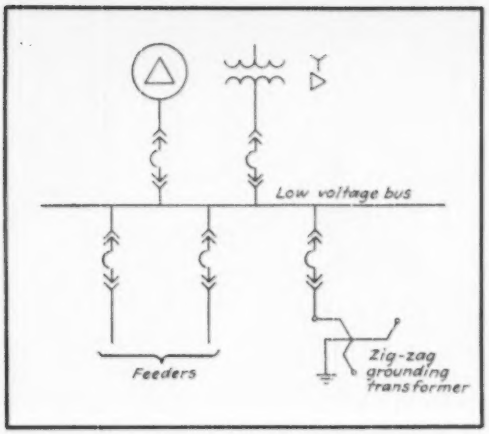


FIG 2—**SYSTEM NEUTRAL** provided by a grounding transformer

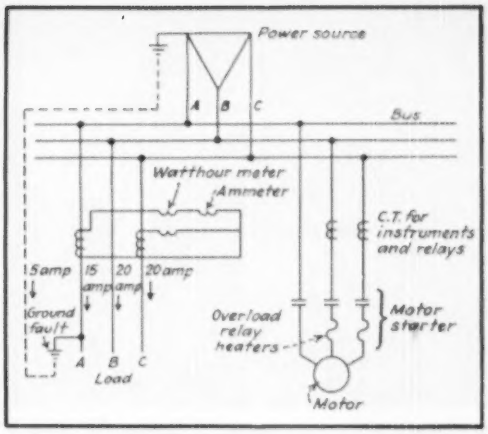


FIG 3—**PHASING-OUT** power system for corner-of-delta grounding

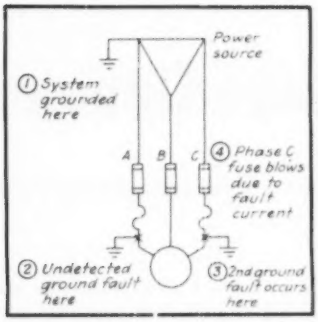

Power source
1 System grounded here
A B C
4 Phase C fuse blows due to fault current
2 Undetected ground fault here
3 2nd ground fault occurs here

FIG 4—**SINGLE-PHASING** may cause a motor failure under certain conditions

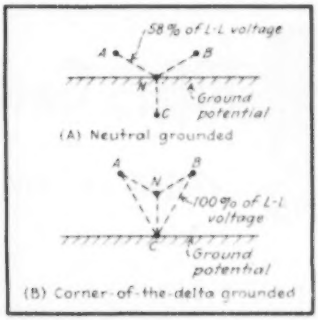


FIG 5—**LINE-TO-GROUND** voltage is less in a neutral-grounded system

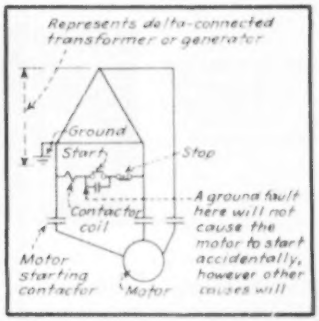


FIG 6—**ACCIDENTAL** motor starting can't be caused by ground fault in control circuit

A Point of Caution . . . If care is not taken to connect the contactor coil to the grounded phase, there is greater likelihood of inopportune motor starting than on a neutral-grounded system. In the first case, the contactor coil voltage may be full line-to-line voltage, whereas, in a neutral-grounded system this will be a maximum of 58% of line-to-line voltage. This is often insufficient to cause the contactor to pick up.

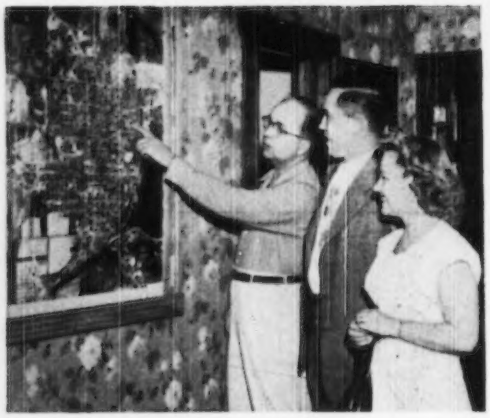
4. It is often advantageous to operate low-voltage industrial power systems, 4-w, 3-ph. Thus, 208/120-v systems may be used directly for 3-ph motors and single-phase lighting. Likewise 480/277-v, 4-w systems may be used for 480-v motors and 277-v fluorescent lighting without lighting transformers. In each case, the neutral is solidly grounded.

5. In some cases, it is pointed out that a grounded-neutral system requires one overcurrent device in each phase, whereas, a one-phase grounded system requires only one device in each of the two ungrounded phases.

However, standard switchgear practice today calls for three circuit-breaker trips or three fuses, depending on which type of short-circuit protection is used. This is true whether the system is neutral grounded, 1-ph grounded, or ungrounded. Therefore, the switchgear is the same for either method of grounding.

The foregoing applies only to short-circuit protection and not to motor overload relays, in which case only two-element relays are required regardless of the method of grounding. In those cases where there is a wye-delta or delta-wye transformer ahead of the low-voltage circuit and which has a fused primary, it is sometimes considered necessary to have a three-element overload relay on each motor starter. However, practical experience has shown that, except in a few special cases, two-element overload relays are satisfactory. There are many systems in operation today having these conditions, that is, a fused wye-delta or delta-wye transformer, in which only two-element overload relays are used. One exception to the general rule is in such cases as isolated pumping stations in which there is only one supply circuit and no synchronous motors to maintain balanced 3-ph voltage when one fuse blows. In these cases three-element overload relays may be desirable.

1 OPERATION of model garbage disposer in City office is explained by City Clerk-Treasurer A. J. Sermersheim, center, to Mr and Mrs Ambrose Wilz. Arrows indicate transparent drain



2 DISPOSER INSTALLATIONS are recorded with colored pins on an aerial view of the city. Mr and Mrs Wilz watch as Clerk-Treasurer Sermersheim spots their house

MEET Mayor Herbert E. Thyen, who conceived the idea of Jasper's 100% installation of garbage disposers

100% Garbage Disposer

Indiana city eliminates garbage pick-up, can

INSTALLATION of 1,400 garbage disposer units by the citizens of Jasper, Indiana, has completely eliminated all garbage pick-up service in this city of 6,000 population. Here's how it came about.

Last year Jasper faced the problem of installing a sewage treatment plant to meet stream pollution regulations. But it was quickly apparent that the capacity of the treatment plant would depend on the number of garbage disposer units installed in Jasper homes, since each such unit would add to the solid matter in the sewage.

The Mayor Had An Idea . . . Since garbage disposers were growing in popularity in Jasper, according to a spot survey, it was felt that the treatment plant should have sufficient capacity to handle a high saturation of disposers. At this point Mayor Herbert E. Thyen came up with the idea of installing treatment facilities for a 100% saturation of disposers, pushing their installation, perhaps through city financing, and doing away with garbage pick-up. The collection of garbage had become more and more expensive, particularly since farmers in the surrounding area had lost interest in using garbage as hog feed.

Mayor Thyen's idea got such an enthusiastic reception that plans for city financing of disposer installation was abandoned. Property owners were sold on the idea of paying the installation costs. This saved the public the cost of long-term financing, which would have been necessary for city financing, a cost which would have been passed to the public on tax bills.

Today 70% of the home owners have signed up for disposer installations. Work on all installations was finished last month and the city has discontinued garbage pick-up.

Estimated cost of operating a disposer is 8c per month in Jasper. The effect of the disposers on the City's electric system is expected to be negligible, because motors are small, operating time probably not more than two or three minutes a day and diversity is expected to be very high.

Electric load at the treatment plant, which went into operation in June of this year consists of a 75 hp motor, the same size that would have been installed without garbage disposers.

Demonstrations Show How . . . As a stimulant to the signing of customers for disposer installations a demonstration unit, with a transparent section of pipe in the drain, was set up in the city office, where light and water bills are paid. Alongside the demonstration installation a map of the city was placed and for every customer signing for a disposer installation a red pin was placed on the map. These attracted the attention of customers and visitors who came from distant points to learn of Jasper's solution to the garbage problem.

To assure satisfactory operation, a separate circuit is installed in home for the disposer. This circuit has enough capacity to handle the future

3 **THE JOB IS FINISHED** at the Wilz home, 1322 Leopold St. Mrs Wilz smiles happily as plumber Carl Ress gathers up his tools. Device (arrow) is special tool for enlarging sink drains

4 **SHOWING THE NEIGHBORS** her new garbage disposer, Mrs Wilz proudly explains the "do's" and "don'ts" to Mrs Margaret Theil, right. About 70% of home owners have signed up

Installation Saves City $6,000 A Year

maintenance, and fly, rodent and stray dog nuisance

installation of a dishwasher.

An important factor in the low cost of installation of disposers in Jasper was development of a tool for cutting larger drain holes in existing kitchen sinks. This simplified the problem of mass installations.

Purchase of disposers was made from a single manufacturer, based on sealed bids plus elaborate tests comparing unit performance. To determine the thoroughness and speed with which disposers will handle kitchen waste each disposer was tested with a standard two quart composit garbage sample, one quart of waste being placed in the disposer at a time. Disposer was operated for one minute, only half the time required for grinding that amount, based on design calculations. Garbage passed and that not passed was inspected and records made on each unit under test. This test was made with normal water volume.

Another test was made to evaluate the need for a water interlock on all installations. In this test one pound of green beans was placed in the disposer and the disposer operated for one minute. Although this test indicated that without water there would not be enough material passed to cause trouble in the sewer it was decided that, to be on the safe side, water interlocks would be installed.

Four Methods Compared . . . In reaching a decision on garbage handling the Mayor and City Council had estimates made on the cost of constructing, maintaining and operating garbage disposal by (1) the installation of household grinders, (2) the collection of garbage by truck and hauling to a central grinder to be located at the sewage treatment plant, (3) by the sanitary land fill method and (4) by the garbage farm method. Methods 1 and 2 obviously contemplated revision of plans for the sewage treatment plant to provide for dual disposal. Consequently the estimates included the cost of plant additions required thereby. Method 4 was included primarily for comparative reasons, its continued use by this time having been accepted as relatively impracticable.

Reduced to a monthly cost per family, or customer, these estimates showed the following amounts:

Method 1 . . . . . $0.65
Method 2 . . . . . $1.04
Method 3 . . . . . $1.27
Method 4 . . . . . $0.37

On the basis of these estimates it was decided that household garbage disposers should be installed, it being realized that even though that method did not offer any advantage in cost, it offered other inestimable benefits such as, elimination of garbage can maintenance, fly, rodent and stray dog nuisance, relief of street and alley traffic congestion by garbage trucks and a general improvement to the esthetic and sanitary condition of the city.

Immediate savings to the city through elimination of garbage pick-up is estimated at $6,000 per yr. Future savings up to $13,000 per yr are anticipated.

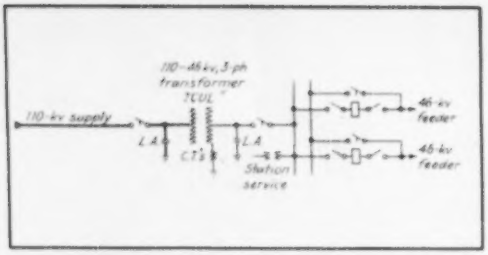


FIG 1—SINGLE LINE DIAGRAM of a new 110—46-kv substation with one 3-ph tap changing under load transformer and two 44-kv feeders—although there may be more feeders. There are no 115-kv breakers, 110-kv line breaker acts as high side bank breaker

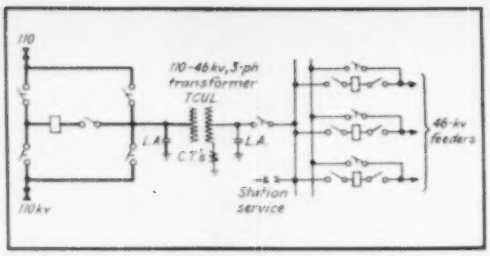


FIG 2—SAME STATION of Fig 1 with 110-kv line extended to another source of supply. The 110-kv line now carries thru traffic and a fuse or breaker provides both station and thru traffic protection on the 110-kv line in case of a station fault

Basic Substation Bus Patterns

Georgia Power guides design of substation bus layouts by watching operating record of various schemes. How vigilence pays off in reduced initial investment, maintenance, and operating problems is told here

E. J. ARCHBOLD, Mechanical Engineer
Georgia Power Co, Atlanta, Ga.

ADVANCES in the art of production, transmission, and distribution have a very definite influence on the basic single-line diagram of a substation. Not many years ago, a breaker might require a good detailed inspection and considerable work on it after just a few automatic operations within its rating. Today modern breakers can take dozens of automatic operations without any detailed inspection. Performance of other equipment, such as transformers, lightning arresters, relays, etc, has also been materially improved in the past 10 to 15 years. The advent of the counterpoise on transmission lines, together with improved designs and the proper application of ground wires, has changed the number of interruptions from transient faults on some lines from a dozen or two dozen per year to but one operation or perhaps none. All these changes in equipment and plant should be reflected in the basic single line diagram of substations.

Fig 1 is the single line diagram of a new 110-46-kv substation on the Georgia Power system. Such a new substation is usually built within a year or two after the load in the area has increased beyond the reasonable capacity of the 44-kv lines. Notice that the station has but one 3-ph tap-changing-under-load transformer and two 44-kv feeders—although there may be more feeders. No 115-kv breakers are installed, as the breaker at the supply end of the 110-kv line serves as a high side bank breaker. The transformer is equipped with 121 and 40-kv lightning arresters mounted on it; and all three of the 46-kv winding neutral leads are brought out of the tank and metering current transformers connected in them before the neutrals are grounded. The 46-kv transfer bus is installed for the purpose of taking a breaker out of service without eliminating any protection; and the low side bank disconnecting switch merely serves the purpose of taking the bank out of service while the 46-kv bus remains hot.

Three-Phase vs Single-Phase . . . The 3-ph transformer takes the place of the four 1-ph transformers of a few years ago. Thus has been recognized the fact that with modern transformers, properly protected, we do not need 33⅓% of our connected transformer capacity standing idly by as spares. The insurance premium of 33⅓% on transformers was undoubtedly justified at one time, but the 1-ph transformer offers a cruel choice—either no insurance or a premium of 33⅓%. Even when the full premium is paid, the situation is not a happy one—consider a station that is fully loaded with 33⅓% of its capacity not at work, yet still in no position to assist a neighboring station in time of trouble. The 3-ph transformer, when properly co-ordinated with capacity in the tie lines, permits a wide latitude of the insurance premium. Incidentally, the standard Georgia Power Co 110-46-kv 3-ph

Adapted from author's paper entitled "Fundamental Substation Bus Arrangements" presented before the Engineering and Operation Section Conference of the Southeastern Electric Exchange at Biloxi, Miss.

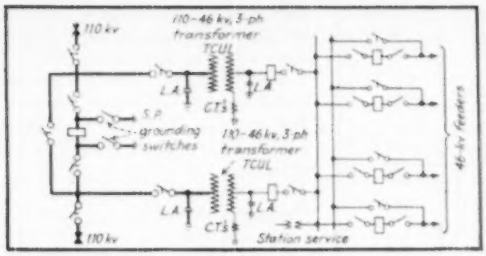


FIG 3—THIRD STEP shows addition of second transformer, two 46-kv oil circuit breakers and two grounding switches. The 115-kv breaker is now a line breaker, instead of a high side bank breaker, and grounding switches are required for transformer protection

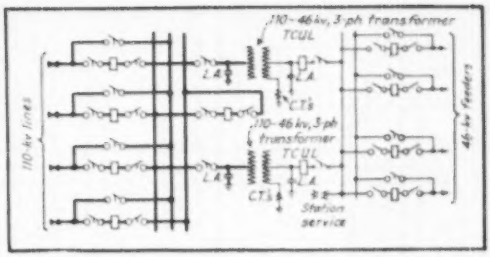


FIG 4—FOURTH STEP shows four 110-kv lines serving station using four 115-kv breakers with one 115-kv breaker per line and one 115-kv breaker for the two transformers. Station is operated as two separate stations from standpoint of 110-kv bus and transformers

Proved by Operating Record

transformer is a triple-rated transformer, having an overload rating of 166% of its self cooled rating.

The lightning arresters, mounted on the transformers, are a major part of what this company considers proper protection of transformers. A transformer is the most expensive single piece of terminal equipment in the station, and also requires a longer time for repair, so the arresters are connected as close to the transformer as possible. The tank walls of a large 3-ph transformer appear to be an ideal place for the installation of the arresters—and the cost of foundations and supporting structures for the arresters is saved in addition.

Adequate Shielding . . . Proper protection for the station terminal equipment also implies that the station be adequately shielded. This, of course, does not show up on the single-line diagram—but the ground wires on the lines are brought over the station and tied into the station ground system.

The tap changing under load equipment in the transformer replaces the conventional regulating transformer with its cut-out switches, bypass switch, foundations, and steel structure for the switches. The operating record on modern tap changing equipment also dictated this change, and the savings are very obvious—both as to the initial cost and maintenance. Incidentally, the buck and boost in a conventional regulating transformer are equal, and with a 20% regulating transformer it is 10% boost and 10% buck. The Georgia Power Co 110-46-kv tap changing under load transformers also have a 20% range, but it is 12½% boost and 7½% buck. This is also a help, as we are confronted far more often with low voltage than with high voltage.

The connection of the metering transformers in the neutral end of the 46-kv windings permits the use of lower cost current transformers and also reduces the possibility of station outages due to current transformer failures. This has been a standard practice of the Georgia Power Co for the past 14 or 15 years, but I am ashamed to admit how many 50-kv current transformers were purchased before we woke up to the fact that the current was the same in both ends of the winding and then did something practical about it. Here again the tank wall of the power transformer serves a useful purpose other than housing the transformer, for the current transformers are mounted conveniently on the tank wall.

Two Supply Sources . . . Fig 2 is the same station, but now the 110-kv line has been extended to another source of supply, thus giving the station two sources of supply. The 110-kv line is now carrying thru traffic and a fuse or oil circuit breaker has to be installed for both station protection and protection of the thru traffic on the 110-kv line in case of a station fault. When a breaker is installed as a high side bank breaker, it is always connected so that it can be used to switch line load on either side of the station. This feature is of no particular help in the maintenance or operation of the station, but it is of primary value in line maintenance.

Our basic single line diagram of a few years past would have employed two line sectionalizing switches, two breaker cut-out switches, and a breaker by-pass switch—a total of five 115-kv switches. The breaker would have been a high side bank breaker and nothing more. The present scheme also employs five switches, but the breaker can be used for more than a high side bank breaker.

Fig 3 shows the third step. The load in the area has now grown to the point that the second transformer has to be installed.

In addition to the 2nd transformer, we have had to add two 46-kv oil circuit breakers and two grounding switches. The 115-kv breaker has been changed from a high side bank breaker to a line breaker, and the grounding switches are required for transformer protection. The grounding switches are single pole spring operated switches actuated by the transformer differential relays. The zone of protection of the differential relays extends from the bushing type current transformers on the high

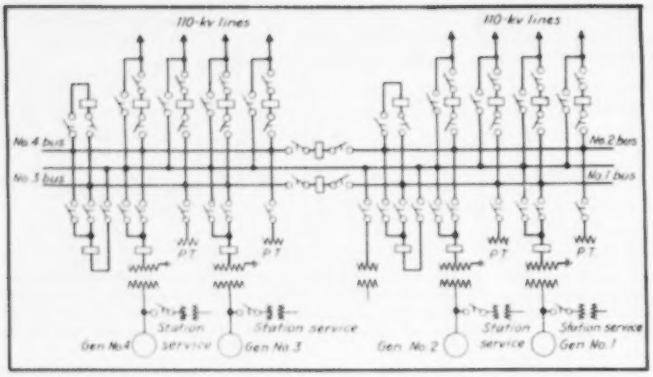


FIG 5—PLANT YATES station single-line diagram showing the four 100,000-kw units. Diagram is fundamentally the same as previous diagrams. Station is split into four stations

voltage bushings of the transformers to the bushing type current transformers on the bus side of the low side bank breakers.

In this layout the fact has been recognized that operating records on modern transmission lines permit connecting the transformer direct to the line. Not too many years back we would have had at least three 115-kv breakers in a station of this type instead of only one—a breaker for each line and a bus tie breaker. A few years before that there would have been four 115-kv breakers—one for each line and a breaker for each transformer bank.

The use of the grounding switch to deliberately fault the line and stop thru traffic in case of a fault in the transformer indicates we have faith in the modern transformer, and the modern relay when properly applied. This was not true just a few years ago. Incidentally, there is a loss of about 15 cycles in clearing a faulted transformer from the circuit, as the operating time of the grounding switch and instantaneous ground relay tripping the supply breaker add up to about this figure. In the case of a faulted winding this 15 cycles may mean the loss of a little more copper and possibly iron. To date we have not had an operation of this type.

The elimination of the bank side cut-out and by-pass switches on the low side bank breaker shows we have taken advantage of the improved performance of the modern breaker.

Skipping a step or two, the same station with two additional 110 kv lines is shown in Fig 4.

Note that when a jump was made from two 110-kv lines to four 110-kv lines it was necessary to add four 115-kv breakers. However, there is still but one 115-kv breaker per line and one 115-kv breaker for the two transformers.

Operated As Two Stations . . . This type of station is actually operated as two separate stations as far as the 110-kv bus and transformers are concerned. The transformer differential zone of protection now takes in its section of 110-kv bus—thus the zone extends on transformer No. 1 from the bushing type current transformers on the bus side of its low side bank breaker to the bushing type current transformers on the line side of the line breakers connected to the No. 1 bus and the current transformers on the No. 2 bus side of the bus tie breaker. The 110-kv transfer bus has the same function as the 44-kv transfer bus—it permits maintenance of breakers without taking a line out of service or removing any protection on the transformer.

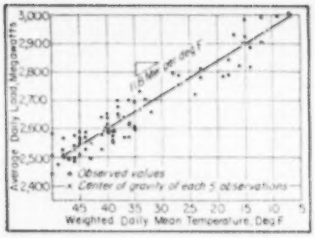
When the station has really become of age, the single line diagram looks like Fig 5. This is the company's Plant Yates single line with the ultimate four 100,000-kw units. The first two units are in the final stages of completion.

This diagram is fundamentally the same as the preceding diagrams. We have simply gone a step further and split the station up into four stations. There is, however, one feature that is somewhat more elaborate, and this is the addition of the transfer breaker. While this breaker normally serves as the high side bank breaker for the station service transformer required to start the plant, it can also serve as a line breaker for any of the lines. This eliminates the use of one breaker for two lines while a breaker is out of service.

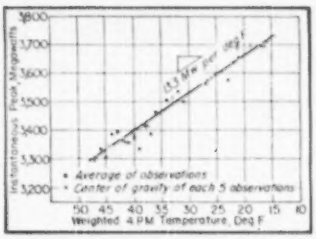
Definite Pattern . . . All the five single line diagrams have a definite pattern. No disconnecting switches are employed unless absolutely necessary—disconnecting switches have a bad habit of becoming obsolete. Oil circuit breakers have also been used very sparingly—they are even worse than disconnecting switches when it comes to getting out of date as far as operation is concerned. In addition, an oil circuit breaker cannot be installed without additional relays, disconnecting switches, etc, to the tune of a figure about equal to the cost of the breaker itself. One other thing about a breaker that leaves a bad taste; it doesn't grow with the system, and if one doesn't watch closely he will find himself with breakers in places where the duty far exceeds even the published rating.

There is one thing about these diagrams notable—the use of more buses than may perhaps be normally encountered. But a bus is a fine thing as far as maintenance and operation is concerned—it doesn't need modernizing, and no one can tell, by looking at the copper or aluminum in a bus, whether it is a 1950 model or of 1920 viltage. In the past Georgia Power employed the double bus scheme with selector switches so that we could switch to either bus in case of bus failures. But the records show that practically the only times that the switching was done was at the time the selector switches failed or were modernized.

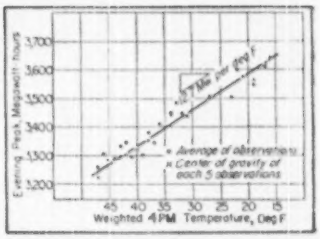
To summarize, we in the Georgia Power Co have been making a serious effort to make the operating record our guide in the design of substations instead of our personal opinions; and to keep the single line of the substation, and therefore the substation, down to its basic fundamental functions. We are convinced that our operating records show that when we stick to the fundamentals, we not only materially reduce the initial investment required but we also have less headaches.


Average Daily Load, Megawatts
11.8 Mw per deg F
• Observed values
× Center of gravity of each 5 observations
Weighted Daily Mean Temperature, Deg F

LOAD VARIATION of 11.8 Mw per deg F as function of weighted daily mean temperature was established by western group of the Northwest Power Pool during the winter of 1949-50, when temperatures varied widely


Instantaneous Peak, Megawatts
13.3 Mw per deg F
• Average of observations
× Center of gravity of each 5 observations
Weighted 4 PM Temperature, Deg F

DISPATCHERS PREDICTED maximum instaneous load with excellent accuracy after determining that the variation was about 13.3 Mw per deg F of the weighted (in proportion to load) 4 pm temperature


Evening Peak, Megawatt-hours
12.7 Mw per deg F
• Average of observations
× Center of gravity of each 5 observations
Weighted 4 PM Temperature, Deg F

EVENING PEAK HOUR load varied approximately 12.7 Mw per deg F based on the 4 pm temperature. Below 47 deg F all areas had temperature responsive load large enough to overcome other variable factors

Northwest Pool Determines Load-Temperature Ratio

W. T. CONNOLLY, Washington Water Power Co
L. K. SMITH, Portland General Electric Co
(Both Assigned to Inter-Company Group of Northwest Power Pool)

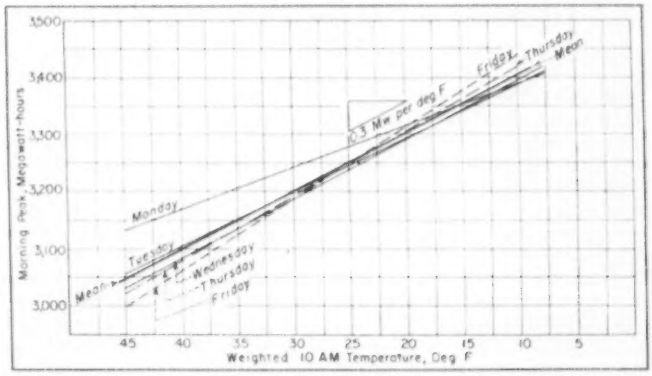
ANALYSIS of the effect of temperature on load of the western group of the Northwest Power Pool indicates that for winter temperatures rather consistent straight line relationships exist between temperature change and load change. It was found, generally, that an average temperature of 47 deg F or lower would assure all areas of a temperature-responsive load big enough to overshadow other variable factors. Loads at temperatures higher than this were ignored in determining the trend lines shown in the accompanying illustrations.

Extreme temperatures during the winter of 1949-50 gave enough observations over the entire temperature range of the area and provided a much wider range of investigation than a normal year would have done. Results showed conclusively that the size of load change with temperature makes it imperative that temperature be considered in load predictions. A factor of this importance has a large bearing on the total cost of operation of a power pool.

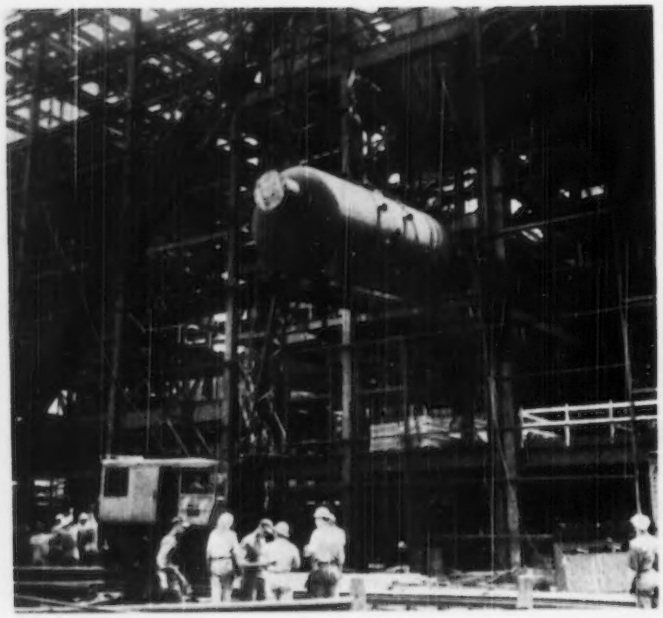
Three Load Areas . . . Western group of the Northwest power pool may be separated into three large load areas: First is the Puget Sound area; principally Seattle, Tacoma and Olympia; second the Portland area, about 200 miles south, and third Spokane, located about 300 miles inland.

Puget Sound and Portland are both near the coast and have approximately equal loads. Generally speaking, their weather is similar. Spokane is nearly 2,000 ft above sea level, and is separated from the coast by the Cascade mountains, which gives it climatic conditions materially different from the coast. Load in the Spokane area is about 60% of either of the other areas. To arrive at a single regional temperature variation, temperatures from Seattle, Portland, and Spokane were weighted in the same ratio of 1.0:1.0:0.6 and averaged.

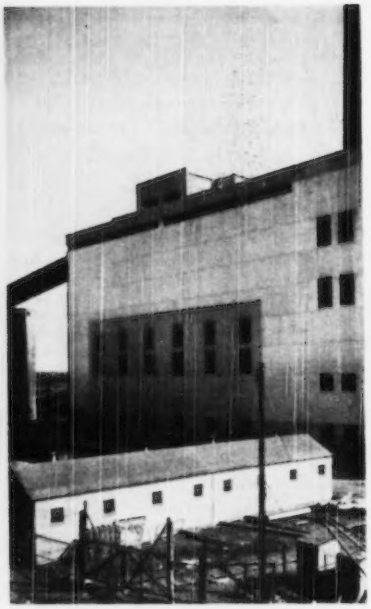
Eastern group of the pool (Utah-Idaho-Montana) amounts to about 18% of the total pool peak, but temperatures have been found to have very little effect on their load, so the group was omitted completely from the load-temperature study made by the pool.



MORNING PEAK HOUR variation of 10.3 Mw per deg F, based on weighted 10 am temperature, is illustrative of consistency of the temperature effect on peak for different days



ALUMINUM PANEL glass insulated, besides costing 2/3 as much as brick, made it possible to leave the end of the building open during most of construction period. Equipment could then be unloaded and swung by cranes directly into place through the open end of the building



CONSTRUCTION BUILDINGS were located as conveniently as possible, as can be seen from the one in the foreground. This pleased

Mechanization and Coordination

Maximum use of mechanized equipment and plenty of cooperation makes for quick construction of sound workmanship. Project cost was under $118 per kw

G. J. SAMPSON and NEIL WADSWORTH Construction Engineers
The Toledo Edison Co, Toledo

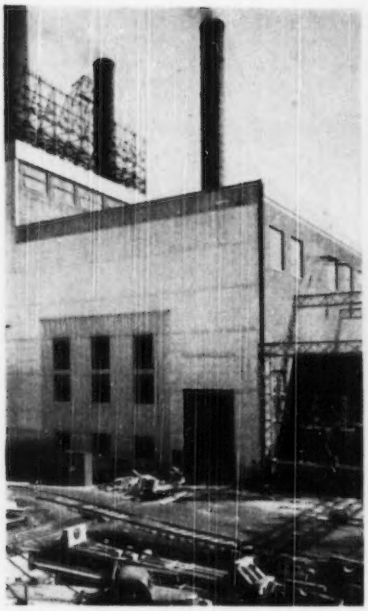
TEN MONTHS from setting of first steel to operation of 100 Mw unit is the record set by Toledo Edison when pressed by system needs. Mechanized equipment, convenient working conditions, cooperation with construction crews and building design were key factors in fast construction and the low-cost of $118 per kw at the company's Acme Station. Installation consists of 90/105 Mw generator, 70,000 sq ft condenser, and two 500,000 lb per hr boilers. Throttle steam conditions are 825 lb, 950 F with seven stages of bleed heating. Heat rate is 11,400 Btu per kwhr.

Most notable feature of building design which tended to accelerate construction was the use of glass insulated aluminum panels for exterior walls. Since this type of wall can be erected quickly, the sides of the building were left open as long as possible. This permitted building materials and machinery to be unloaded and landed in the building at the desired elevation in one operation. The panel wall was purchased on an erected basis and the manufacturer shipped as required for erection. Fifty-five thousand sq ft of wall was erected in 65 days.

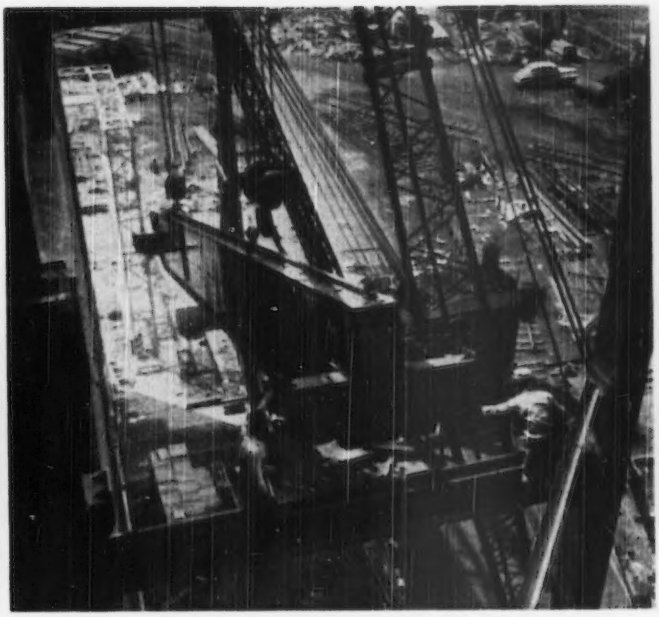
Deliveries were still a big problem. Each supplier was shown a copy of the construction schedule, assuring him that the needs were real. In cases where a number of suppliers were involved on one contract, the manufacturers welcomed assistance in expediting deliveries to them. In one case the fabricator's shop was visited once each week for six months. This policy proved surprisingly successful.

The company's local design engineers were forever pushing to get approved drawings in the manufacturers' hands at the earliest possible moment, while an experienced traffic man arranged special truck hauls and had railroad cars sent into the plant as required.

Satisfied Workers Accelerate Job . . . The labor market was very com-



workers and supervisors and speeded work. Aluminum wall panel is here shown in place, 55,000 sq ft having been erected in 65 days



TURBINE ROOM BRIDGE CRANE was erected in one day. Assembled on ground, it was lifted by two large cranes to supporting beams which extended beyond building wall. It was moved along beams to position in turbine room. Protruding beam ends were cut with torch

Put 100 Mw on Line in 10 Months

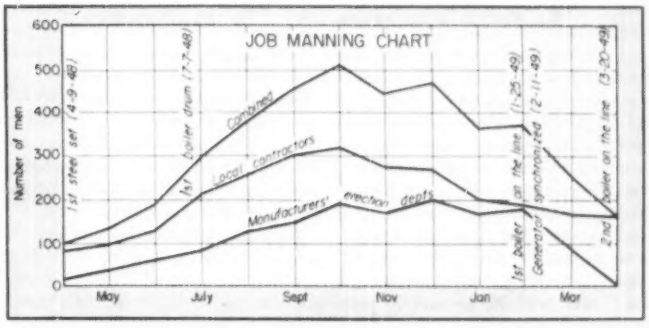
petitive at the time of construction. To make the job more attractive, a separate road and parking lot were constructed adjacent to the work.

Three 24 ft by 65 ft workmen's buildings were put up and equipped with electricity and running water for the shelter and convenience of workmen. As soon as construction permitted, drinking fountains and limited toilet facilities were provided at different elevations in the new structure, not only for the workmen's convenience but to save time.

Three Exits Speed Checking Out . . . At quitting time three exits were made available for checking out. This avoided a lineup and prevented a tendency of men quitting early in order to be at the head of the line.

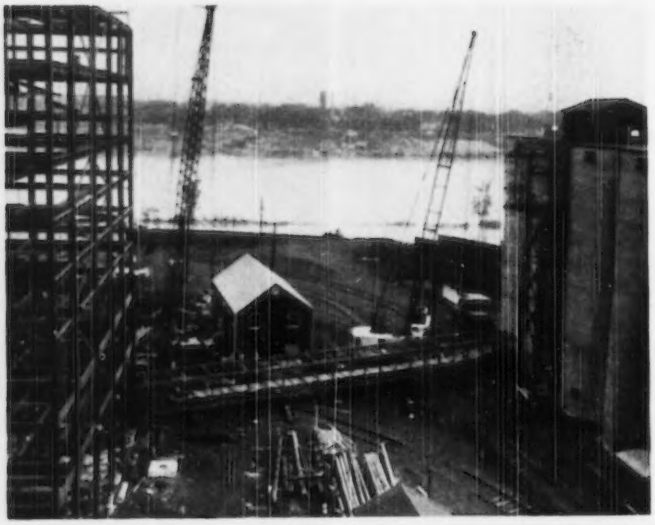
Since the attitude of the various construction superintendents and foremen is reflected by their men, every reasonable effort was made to provide facilities to satisfy this supervisory group. If a foreman desired a different location for his office or workmen's quarters, the buildings were moved to the desired locations whenever possible. As a result of such consideration, there was no undue difficulty in securing workmen.

In order to get specialized erection contractors, equipment was purchased on an erected basis providing the vendor's erection department was well-known enough to have a following among building trades people. All contracts were let direct in order that Toledo Edition's construction engineers would have first-line au-



AT PEAK of construction operations more than 500 men were working on the job

CHANGING LOCATIONS of offices or workmen's quarters was but little trouble



COAL CONVEYOR GALLERY was lifted into place by two cranes after it had been assembled on the ground. Roof truss members were also riveted on the ground and lifted into place

thority to coordinate the job. To take advantage of a general contractor's organization and equipment, a local general contractor was employed to handle substructures, foundations, brick work, electrical work, and instrumentation. This contractor was also called upon to do any other work as directed on force accounts. This arrangement relieved the company of the tasks of labor procurement, construction equipment procurement and payrolls, and allowed the construction engineers to devote full time to coordination of the work. As the purchaser's direct representative, they found the various contractors willing to cooperate on a give-and-take basis and willing to work for the general good of the job.

Mechanization Important Factor . . . When steel erection did not progress fast enough, an extra crane was supplied to feed steel through the building. Since this was not the erector's usual practice, the crane was furnished at such a low rental rate that it would have been unprofitable to the contractor not to use it. As soon as the lower sections of steel work had been riveted, the riveting gangs were temporarily moved to other sections of the building to permit wooden floor forms to be erected. This example of give-and-take permitted electricians and pipe fitters to begin work in a protected area of the building while riveting was still going on overhead.

Another extra dividend stemmed from the considerable interest plant operating personnel took in familiarizing themselves with the equipment as it arrived. The men who were to run the new plant were encouraged to study the installation as it went along. When the time came to start operating, there was no hesitancy and no fumbling. The president of the local union, a turbine operator, was one of the most interested students of the new equipment, and his attitude was reflected by the other men in the plant. The men profited too by being able to talk to the young engineers who designed the system for controlling steam flow.

Mechanized handling of equipment was fitted into this accelerated construction program wherever possible. A small rubber-tired crane delivered material to different locations on the job and a fork-lift truck was used to advantage throughout the building. One specialized use for the fork-lift truck was to serve the brick layers. A wooden rack capable of handling two wheelbarrow loads of brick was made for the truck. Brick and tile were hauled an average distance of 750 ft to serve twelve bricklayers. Manpower necessary was two laborers and an engineer.

Breeching, dust collector, electrical precipitators and induced draft fans were in a bay between the buildings that was rather inaccessible. A guy derrick was erected on the side of the building and made available for the use of three different contractors.

Two cranes working together unloaded boiler drums, raised roof trusses, and erected a conveyor gallery. All members of roof trusses and conveyor gallery were riveted on the ground.

Installation Of Turbine Crane . . . Turbine room bridge crane was erected in one day through the open side of the building by using these cranes. The crane was partly assembled on the ground. Beams for supporting the crane in the building were extended beyond the building wall. The two large cranes, working simultaneously, one on each end of the bridge crane, placed it on the extending beams. It was moved along the beams to its position inside the turbine room. Ends of beams were then removed. This crane was ready for operation on the evening of the second day.

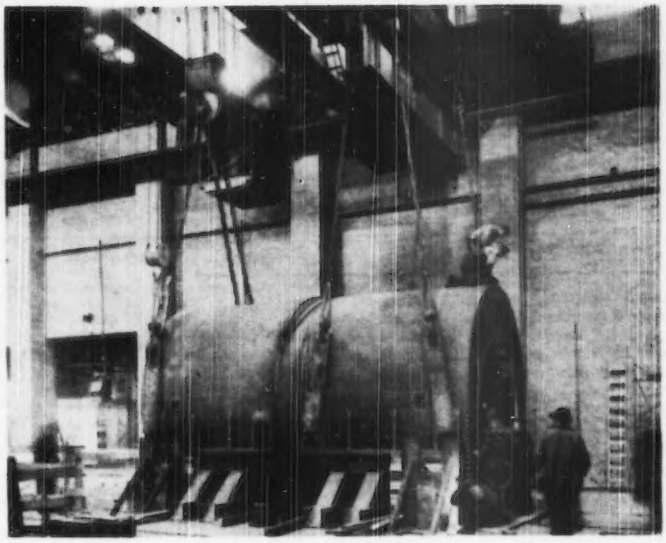
The turbine room was now equipped with two bridge cranes which allowed turbine erection to pro-

ceed uninterrupted with one crane while the other crane was used for maintenance work in the old plant and unloading transformers and other heavy equipment in the new plant. The two cranes were combined to lower the 178-ton generator into place without time-consuming jacking and cribbing.

When the first boiler was ready for drying out the ash pit structure had just been delivered. Steel floor deck was placed across the opening in the bottom of the hopper-type furnace and covered with sand. This enabled the drying out with a gas fire and the erection of the ash pit to proceed simultaneously.

Deadlines Are Revised And Met . . . At this time revised estimates were requested on the minimum time necessary to complete each phase of the work. All job superintendents and foremen concerned were asked to help formulate detailed plans to meet these new deadlines. The men worked hard to meet the deadlines that they themselves had helped to establish. Overtime was used extensively at this stage of construction and nearly all deadlines were met.

The turbine was tested mechanically and was tripped out on the overspeed trip just 10 months and one day after first steel was set. The following day it was put into commercial operation. Capacity was limited to 60,000 kw until the second boiler was put on the line a little more than five weeks later.



TWO BRIDGE CRANES in the turbine room were combined to move the 178-ton generator and lower it into position without time-consuming jacking and cribbing

Apparently, fast construction places no undue penalty on job cost. Based on the 100,000 kw capacity at which this machine is base-loaded, the project cost was just under $118/kw.

Ordinarily a speedy construction job is associated with a large supervisory force and a lot of overtime. Neither of these factors was present on this job. The operating record to date, with no forced outages or shutdowns for changes, indicates that the construction was sound and that the operators did a good job in becoming acquainted with the equipment as it was installed.

Fabric for Duct Joints Resists High Temperature

A NEW METHOD of making high temperature expansion joints in gas ducts is now available. It makes use of silicone rubber coated fiberglas cloth, known as Cohrlastic 3032, which is said to withstand continuous exposure to 450 F. It is not affected by carbon dioxide or sulphur dioxide and resists exposure to mild concentrations of sulphuric acid (up to 10%). All of these properties, plus its ease of installation, make the cloth suitable for enclosing gas duct expansion joints.

Installation Is Simple

The installation of the fabric joint is relatively simple. The material is a cloth $\frac{1}{32}$ in. thick, available as yard goods 36 in. wide. It is necessary only to cut the material to the required width and bolt it under strap iron. Bolt holes can be punched in the fabric with a hand punch and hammer. When temperatures encountered are under 450 F, it is sufficient merely to fasten the material flat around a duct when it is cold, ie maximum joint clearance, and when the duct expands the fabric will wrinkle up.

Because this material will only stand 450 F, it is necessary to move it away from higher gas temperature which could be anything up to 900 F. An asbestos gasket between the cloth and the channel iron prevents heat from being transmitted along the channel iron to the silicon rubber. Excess material is gathered in the corners to allow $\frac{1}{8}$ in. of lateral movement. Any amount of lateral movement could be provided for by this gathering method.

The material is adaptable to many places in steam generating plants, already having been used to seal corners and vertical expansion joints of boilers. It is contemplated that many other types of joints and ducts in steam generating plants can be sealed by using this cloth.

Gas Type Seal

When a gas type seal is necessary, this material may be cemented either to itself or to metal with a silicone rubber cement. Cohrlastic 3032 is made by Connecticut Hard Rubber Co of New Haven, Conn.

Relay System Cuts Pulverizing Costs

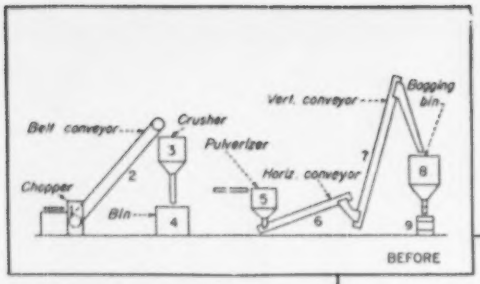


FIG 1—BEFORE mechanical changes were made in the materials handling equipment for pulverizing line, crusher and pulverizer operated intermittently. Production averaged only 188 lb per man-hour. Fires occurred on average of once a month. System created a dusty atmosphere in room

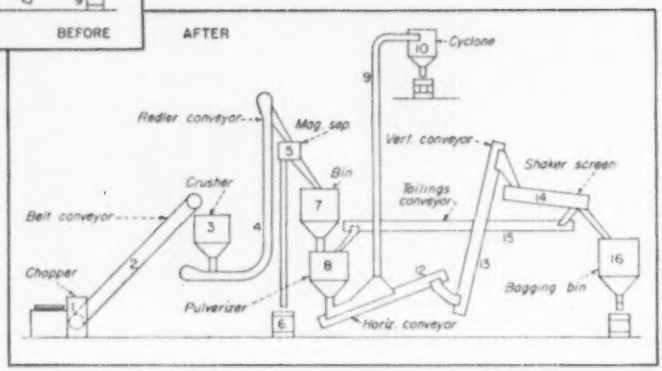


FIG 2—AFTER equipment layout was revised, additional materials handling equipment and system of electrical interlocking relays installed, production was increased to 1,000 lb per man-hour. System fires have been eliminated, and atmosphere dust materially reduced—resulting in fewer hazards and improved working conditions

How the installation of an ingenious system of electrical interlocking relays with a modified materials handling system increased production from 188 to 1000 lb per man-hour, decreased cost of pulverizing and improved working conditions for operators

E. A. GLOSS, Chief Engineer
Irvington Varnish and Insulator Co., Irvington, N. J.

IN ORDER to increase production and decrease the cost of the pulverizing operations in the Harvel Resin Department of the Irvington Varnish & Insulator Co, certain mechanical changes were made in the equipment, particularly relating to materials handling. In order to obtain the full benefit of these changes it was necessary to design and install an ingenious system of electrical interlocking relays.

Fig 1 shows the arrangement of the equipment before the above mentioned changes were made. The large cakes of resin, were fed into the chopper (Item 1) and cut into small pieces. These pieces were carried up on the inclined belt conveyor (Item 2) to a crusher (Item 3). From the crusher the crushed material fell into a collecting bin (Item 4) of 1500 lb capacity.

After the bin was full, the crusher and its related equipment was shut down; two large doors on the front side of the bin were opened and the crushed material was shoveled into 5-gal buckets. These buckets were handed up to an operator on a platform who dumped them into the feed hopper of a micro-pulverizer (Item 5). The pulverized resins were taken away by a horizontal screw conveyor (Item 6), elevated by a vertical conveyor (Item 7), deposited into a bagging bin (Item 8), and withdrawn into drums (Item 9) for shipment to distributors.

The system had certain inherent disadvantages. While the crusher was operating, the pulverizer was idle and vice versa. A crew of four men produced 750 lb per hour or 188 lb per man hour. Tramp metal that entered the system caused fires on an average of once a month. Due to the lack of proper venting, the air generated by the pulverizer created a dusty and annoying atmosphere in the room.

Revised Equipment Scheme . . . To help overcome these disadvantages the equipment layout was revised as shown in Fig 2. Items 1, 2 and 3 are the same as in Fig 1. From the bottom of the crusher, the crushed resin is elevated by a Redler conveyor (Item 4) and deposited into a magnetic separator (Item 5). Tramp metal is removed and dropped down the chute into a drum (Item 6). The cleaned resin particles are deposited

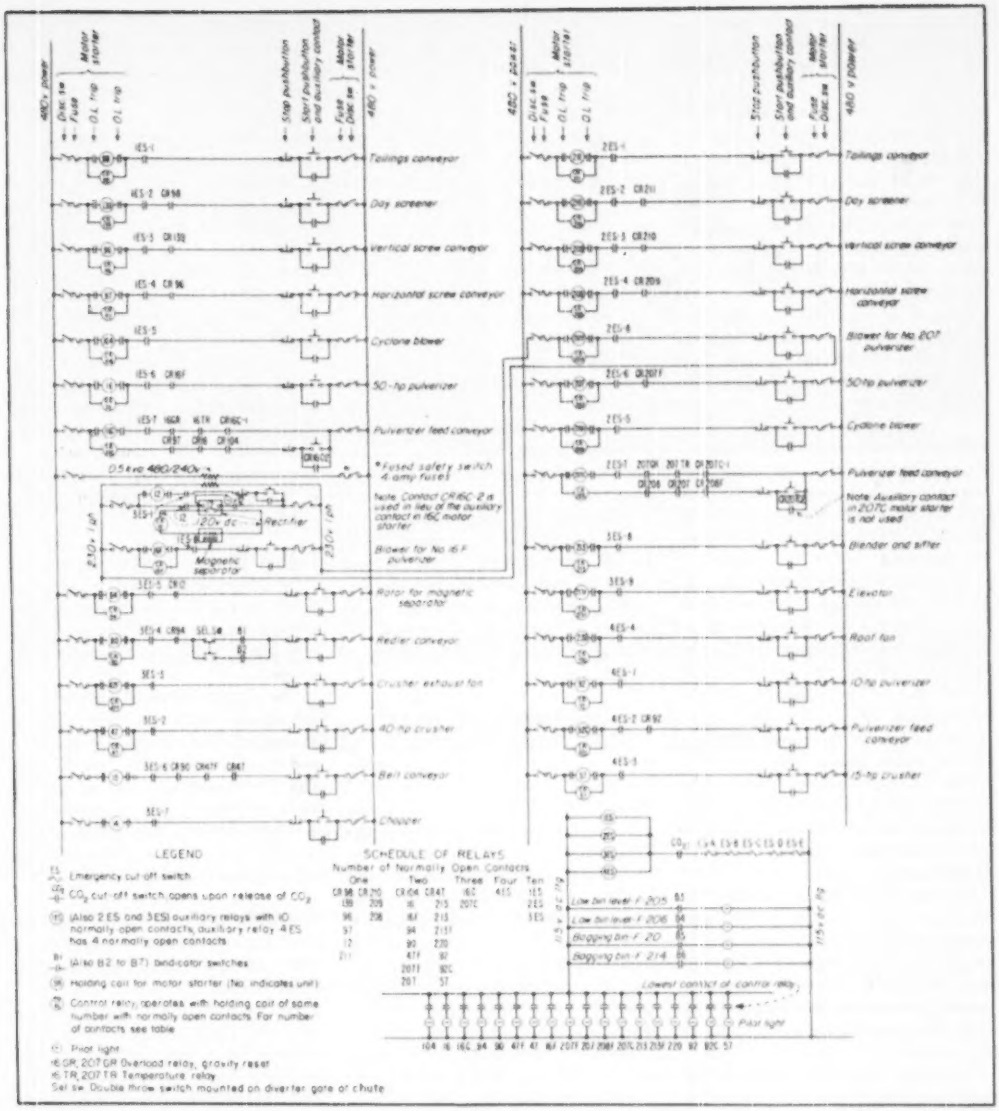


FIG 3—ELECTRICAL INTERLOCK control system enables two men to operate entire revised pulverizer line shown in Fig 2 and to take corrective steps if some of the equipment stops. Should any piece of equipment shut down, it has no effect on any following piece of equipment but it does automatically stop the preceding piece of equipment to prevent jamming up

into a storage bin (Item 7), with a capacity of 4,500 lbs. Incorporated in the side of this bin are two bindicators, the one near the top of the bin is used electrically to control the Redler conveyor as will be explained later. The one near the bottom of the bin is used to operate a pilot light, indicating to the crusher operator when the bin is running low. From the bottom of the storage bin material is fed into the feed hopper of the micro-pulverizer (Item 8).

Air generated by the pulverizer passes out through the vent pipe (Item 9) into a cyclone dust collector (Item 10), which removes the fines and deposits them into a drum (Item 11) for removal later.

The pulverized resin is carried away by the horizontal screw conveyor (Item 12), and elevated by the verticle screw conveyor (Item 13) to the shaker screen (Item 14). Oversized particles are returned to the pulverizer feed hopper by the tailings screw conveyor (Item 15), and the

screened resin dust is dropped into the bagging bin (Item 16) and drawn off into drums (Item 17) for shipment.

In order to use the full capacity of the crusher, another pulverizing line consisting of duplicate equipment to that shown in Fig 2, from Items 7 to 17 inclusive, was installed. A dual chute with a diverter gate was installed between the magnetic separator and the two crushed-resin bins. With this improved layout, 2 men produced 2,000 lb per hour or 1,000 lb per man hour, compared with the production of 188 lb per man hour that was obtained under the manually operated system.

Electrical Controls Needed . . . Due to the fact that only two men were used in operating the entire system, it was necessary to install certain electrical controls for successful operation.

The top line of Fig 3 shows the controls for the tailings conveyor. Item CR 98, the holding coil of an interlocking relay, is inserted around the holding coil of the motor starter (Item 98). The contacts for the interlocking relay CR 98 are in the holding circuit of the magnetic starter for the shaker screen (day screener). If the tailings conveyor stops, the holding coil of CR 98 will be deenergized and the contact points of CR 98 will open, shutting down the shaker screen.

Similar interlocks are inserted in the day screener and the vertical and horizontal screw conveyors so that if any piece of equipment in this group shuts down it automatically stops the preceding piece of equipment and prevents the jamming up of material at this point.

The only interlocks on the 50 hp pulverizer are the contact points CR 16F, which are controlled by the blower for the 16F pulverizer. This blower supplies air for cooling to a housing enclosing the 50 hp pulverizer motor.

The control system for the pulverizer feed conveyor consists of a holding circuit and an operating circuit. When the start button is pushed, relay CR 16C is energized, contact CR 16C-2 closes and maintains the holding circuit when the start button is released, and contact CR 16C-1 closes the operating circuit through the motor starter 16C permitting the motor to start. If trouble arises in either the horizontal screw conveyor (Item 97), the cyclone blower (Item 104) or the 50 hp. pulverizer (Item 16), the contact points CR 97, CR 16 or CR 104 will open, thereby breaking the holding circuit through control relay CR 16C causing it to drop out. At this instant contact points CR 16C-1 will open, shutting off the motor, and contact CR 16C-2 will open breaking the holding circuit permanently, requiring manual restarting.

If the 50 hp motor is overloaded, contact points 16 GR will open stopping the feed conveyor motor. As soon as the overload is cleared, relay 16 GR will reset itself automatically, and the feed conveyor motor will start up again.

Whenever the operating temperature exceeds 200 F, contact points 16 TR open, shutting down the feed conveyor motor until the temperature drops below 200 F, at which point contact points 16 TR will close permitting the feed conveyor motor to start up automatically.

Crusher Operation Control . . . When the crushed resin bin fills up to the top level thereby actuating the bindicator switch, contact points B1 shown in the Redler conveyor circuit, will open thereby shutting down the Redler conveyor. The crusher operator will then turn the diverter gate so that material will flow into the other bin, thereby snapping the selecter switch into the other position. This will disconnect bindicator B1 from the circuit and connect bindicator B2 into the circuit. If this second bin is only partly full, contact points B2 will be closed and the operator is able to start the Redler conveyor and continue with his crushing operation.

A low resistance relay CR 12 is inserted in the dc circuit of the magnetic separator so that if this circuit fails, contact points CR 12 will open shutting down the motor driving the rotor of the magnetic separator. When this happens, control relay CR 94 will shut down the Redler conveyor and relay CR 90 will shut down the belt conveyor. The belt conveyor will also be stopped if either the crusher exhaust fan or the crusher stop.

For Emergencies . . . Emergency cut-off switches are all located at strategic points both inside and outside the building. In the event of a fire, the operator would pull one of these switches thereby deenergizing control relays 1-ES, 2-ES, 3-ES and 4-ES, and since one contact point of one of these relays is inserted in the control circuit of every piece of equipment, therefore, as soon as one of the emergency cut-off switches is pulled, every piece of equipment in the room will shut down automatically and simultaneously.

In addition to the manual emergency shutdown, a complete CO_2 automatic fire extinguishing system was installed including a pressure trip switch. The contact points of this switch (Item CO_2) were inserted in this emergency shutdown control circuit.

Lights Indicates Stoppages . . . Pilot lights are located at strategic points so that if a piece of equipment shuts down, the operator can readily see which piece of equipment has stopped.

The above described electrical interlocking system has been found to be comparatively simple in operation and has been virtually trouble free. The first installation shown by the wiring diagram in Fig 3 was installed in 1944. In 1947 the additional pulverizing line was installed to use the full capacity of the crusher.

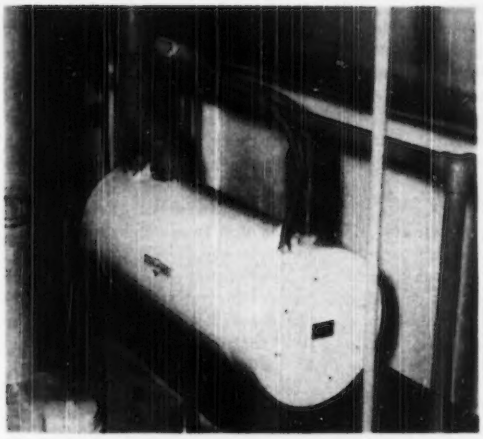
Summing Up . . . There have been three distinct advantages found in the improved pulverizing system described above:

1. The cost of the operation has been materially reduced by increasing production from 188 lb per man-hour to 1,000 lb per man-hour.

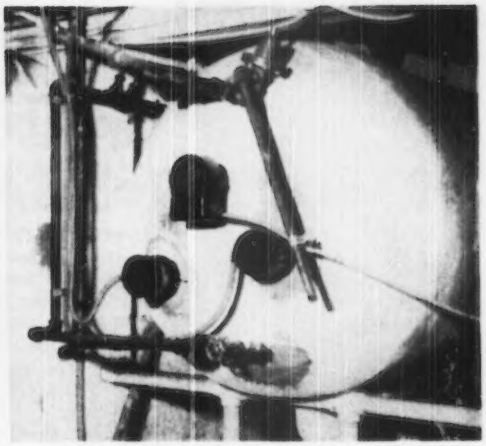
2. Fires in the system with the resulting hazards to the operators, damage to the equipment and loss of production, were eliminated.

3. The dust in the atmosphere has been very materially reduced, improving the operating conditions from a health standpoint.

The electrical control system described above was essential for the realization of the advantages. Since it has given us trouble-free performance for a number of years, it has demonstrated that it was a worthwhile investment.



COMMUNITY LAUNDRY and 25 apartments are supplied all year by this 35-kw circulating heater on a 300-gal tank, formerly heated by an oil-burning boiler. Two thermostats control contactors on 15 and 20-kw elements. Consumption averages 18,000 kwhr per month, or about $135. Unit has needed very little maintenance



INSERTED HEATING ELEMENTS converted this 250-gal hot water heater to electric operation in summer months. Two 5-kw insert heating elements with built-in thermostats were installed in this unit. One heater carries the load (8 apartments), consumption averaging 2,800 kwhr per month, at a cost of $21

We Promote Commercial Water Heating To Build Summer Load

Electric auxiliary water heating units for apartment houses, hotels, save customer expense of operating heating plant in summer

P. C. SPOWART, Sales Manager, Seattle City Light, Wash.

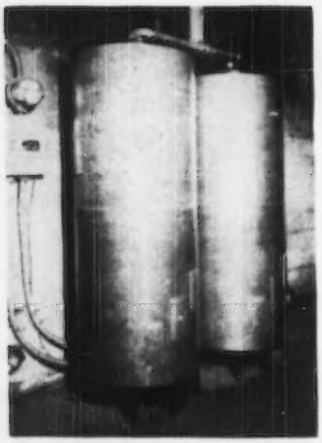
AUXILIARY electric storage water heating in commercial establishments such as apartment houses and small hotels has proved to be an excellent summer load builder for Seattle City Light. Where the efficiency of water heating from the central heating plant of the building is high enough to be economically advantageous over electric, the minimum charge is waived, provided there is no consumption on the meter for water heating during winter months. This way the consumer has the advantage of a standby hot water source at no charge unless it is used. At the same time, the low revenue per kwhr load is eliminated from the winter peak of the system.

Advantage to the customer lies in elimination of the necessity for operating his heating plant throughout the summer months just to provide hot water for his tenants. The electric water heater is entirely automatic, requires no operator in attendance, and with the low rate established, provides a supply of hot water economically.

Special Rate . . . Rate under specific conditions for commercial electric hot water service is ¾¢ per kwhr with a minimum charge of $1.50 per month per kw connected. A 200-hr run per month will absorb the minimum charge. Sufficient kilowatts of capacity are connected to give a desired 400 hr run or 55% load factor. A load factor of 60% or less is desirable in order that water heater peak control, should it become necessary, would not inconvenience the customer. This also provides some measure of reserve for increased use of hot water.

Storage of energy, and controlled load factor justify the higher minimum charge than other power loads, assuring the utility of a better incremental or ready-to-serve revenue. For the same reasons, a lower rate per can be applied and economically justified.

Commercial hot water service actually falls into two classes, which are not sharply differentiated. For continuous use of water, as in a restaurant, a higher wattage to gallons ratio is necessary than in an apartment building or processing



DOUBLING UP two 100-gal standardized units provides 200 gal of hot water storage. Each tank has 7½ kw connected to supply hot water service for 12 apartments and a community laundry. Bills average $54 per month for 7,200 kwhr. This is about the largest size unit which can be taken through standard doorways and located conveniently in space generally available

plant where large draw-offs are made at intervals. By proper ratio of tank size and wattage for any particular case, the load factor is determined and can be adjusted as desired or necessary.

Heaters Specially Designed . . . To implement their program, Seattle City Light designed tanks and heaters which would fulfill the requirements of capacity and ratio of wattage to gallons storage. For the most universal use hundreds of 100-gal tanks with insulation, thermostats and 15-kw heaters were built by two Seattle manufacturers. This 100-gal tank is a packaged unit, the largest size that will go through ordinary doors and fit in the spaces usually provided.

Some 200-gal tanks were made to the same general specifications as the 100-gal units, but were not as satisfactory. They had to be assembled in place because of their larger size, and the infrequent need for them did not warrant their being carried in stock.

The 100-gal tanks are used for most installations. A 20- or 30-gal tank with a single element is satisfactory for wash-up purposes in establishments like a small barber shop, bakery or machine shop. For larger installations a side-arm heater of special design is used or inserts are set in the existing hot water storage tank by cutting and welding. Cutting holes for insert heaters is the least expensive method if location and condition of the tank are favorable.

Insertion Heating Elements . . . Insertion of heating elements in an existing hot water storage tank is practical under favorable conditions and is less costly than a packaged tank. The tank should be well insulated, not too deteriorated, large enough and accessible to work on. One example of such an installation in an apartment building of 8 units had two 5-kw inserts put in a 250-gal tank. Only one 5-kw unit was connected for 2,800 kwhr per month, or 350 kwhr per apartment. The monthly bill at ¾¢ per kwhr averages $21.

Size and Capacity . . . To determine the hot water needs of an existing building, a water meter is set in the cold water feed to the tank. This meter has a contactor which indicates on a graphic chart the time and frequency of any predetermined amount of water drawn off. From the graphic chart and the size of the storage tank the kilowatt capacity required to maintain the hot water supply is determined easily by means of simple calculation.

STANDARD 100-gal commercial-type 15-kw tank which was designed by City Light for commercial loads like this installation in a 42-room hotel. This unit is connected as a circulating-type heater to the 250-gal house storage tank, giving a total of 350 gal. Thermostat (upper left) operates a contactor for the 15-kw heater. Monthly bills average $28.50 for 3,800 kwhr

Ample insulation on the tank and circulating piping is very important. Insulation can mean the difference between success and failure of satisfactory operation of an electrically-heated unit to maintain an adequate hot water supply.

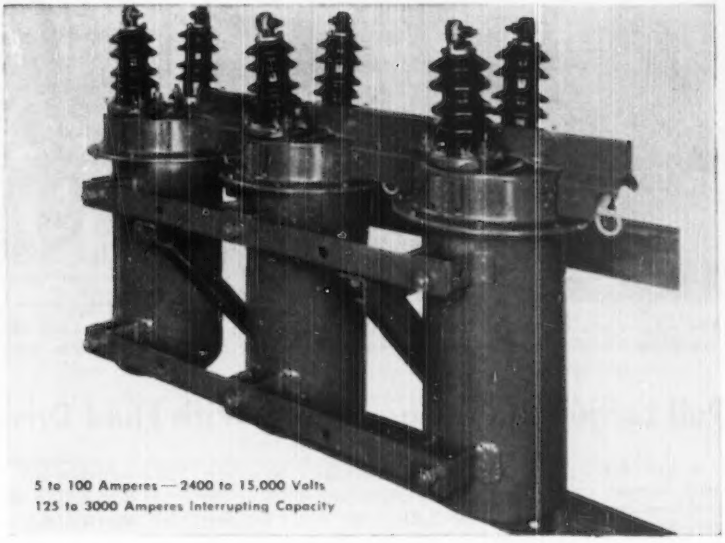
Some leeway in capacity must be allowed for variation from the average use of hot water, figured on the basis that one kwhr represents 4 gal of hot water used (100 deg F rise). As an example, in one building of 12 apartments where two 100-gal tanks were installed, plumbed in parallel and 10-kw heaters connected, an additional 5 kw were required. With no other source of hot water, monthly consumption was about 7,200 kwhr. This averages 600 kwhr per apartment per month, giving a 480-hr run for 15 kw and a total monthly bill of $54, or $4.50 per apartment.

Another 25-apartment building with a 35-kw sidearm heater uses 18,000 kwhr per month at a load factor of 71%. Monthly bills average $135 or $5.40 per apartment for 720 kwhr which is high for this type of load. A 42-room hotel with about 50 people in residence uses a 100-gal tank with a 15-kw heater plumbed in as a sidearm to a 250-gal storage tank. In summer the consumption is about 3,800 kwhr, the bill $28.50. These few examples demonstrate that installations vary considerably, and that individual variations must be considered in making installation estimates.

To Assure Satisfaction . . . For each consumer, City Light carefully considers every commercial water heating installation and generally supervises installations. Equipment is purchased and work contracted for by the consumer from a dealer, not the utility. The utility service man connects the installation, which may require up to 15 kw, and makes any changes necessitated by changed operating conditions. Storage water heating under these conditions is one of the best types of load for an electric utility as it is both easily served and profitable.

new TYPE FR-3

THREE-PHASE AUTOMATIC RECLOSER



5 to 100 Amperes — 2400 to 15,000 Volts
125 to 3000 Amperes Interrupting Capacity

General Electric's new FR-3 three-phase relayed automatic recloser extends the many advantages of the G-E Type FR-1 single-phase recloser to three-phase operation for rural distribution systems. .

SIMPLER — Three FR-1 single-phase reclosers of the design that has been time-proven in service have been combined as a single unit designated Type FR-3. Thus . . .

INTERCHANGEABLE PARTS greatly reduce maintenance costs. As the FR-3 is essentially three FR-1 single-phase units, it's necessary to carry in stock parts for only *one* type of recloser.

COMMON LINKAGE ties together the lock-out mechanism of the three reclosers, thus assuring positive operation. Having three reclosers working as a unit eliminates the hazard of burning out three-phase loads by one phase locking-out while the other two phases remain closed.

INTERMITTENT FAULTS cause the three reclosers to operate independently, as a single-phase recloser.

PERMANENT FAULTS in any one phase will automatically lock-open all three reclosers. Close one and you close all three.

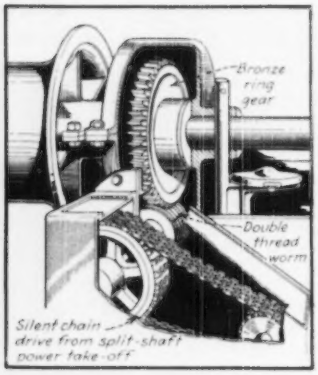
THREE SEPARATE TANKS — instead of one big tank — greatly reduces the possibility of phase-to-phase faults, and thus further improves your service continuity record.

For complete information on the General Electric Type FR-3 recloser ask your G-E Sales Representative for a copy of GEA-5466, or write to *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

PULLING TRACTOR equipped with fluid-coupling transmission, 18-in. diam capstans and heavy duty winch was developed to handle ever increasing sizes and lengths of cable



WINCH is driven through two gears and chain drive from split-shaft power takeoff

Pull Larger and Longer Cable With Fluid Drive

GEORGE W. ROBERTS
Specification Engineer
Underground Lines Dept
The Detroit Edison Co
Detroit

CABLE-PULLING TRACTOR, equipped with fluid coupling, high-efficiency, heavy duty winch and redesigned 18-in. capstans, has been designed to handle the problem of pulling-in ever increasing sizes and lengths of cable. This equipment was developed by Detroit Edison Co, in cooperation with a truck manufacturer.

Removes Old Cable Easily

On the Detroit system, this unit has pulled simultaneously three 138-kv pipe-type cables which were over 2,700 ft long and weighed as much as 65,000 lb total. An unforseen benefit, due particularly to the fluid-drive feature, has been the removal of old cables more easily than was possible with former equipment, and without damage to the cable. This new unit also eases strain on the 1¼-in. pulling rope and eliminates chattering and jerks.

Pulling tractor is on a 3-ton, 21,000-lb gross vehicle weight chassis with 172-in. wheel base. The 6-cycle engine has net torque output of 255 ft-lb at 1,200 rpm. Fluid coupling has a 300 ft-lb torque output at normal operating temperature. Transmission has five speeds forward and one reverse. Split-shaft power take-off has forward and reverse connections to auxiliary shaft and straight-through shaft from transmission to rear axle. All transmission speeds are available at auxiliary shaft.

Winch is driven by tractor engine through the transmission with silent chains between split-shaft take-off and winch worm-gear shaft. Gear ratios between capstan shaft and engine produce these rope tensions and winch speeds at 1,200-rpm engine speed:

Gear	Tension (lb)	Speed (fpm)
5th	8,000	100
4th	12,000	68
3rd	19,000	42
2nd	25,000	23
1st	25,000	13

Winch has a recommended 25,000-lb capacity limit. Cooler operation is attained with a 12-deg, double-helix, 25:1 reduction unit. Two special contour capstans, 18-in. in diam and 15-in. long, are driven by a 50-tooth manganese-bronze ring gear and double-thread, polished-steel worm gear, with radial and thrust roller bearings on worm shaft. Over-all winch efficiency is 72%.

Pulling Long Lengths of Cable

In pulling special, long lengths of heavy cable, fourth gear is used at the start to maintain 45-fpm speed. When engine begins to labor, rope tension is held by emergency brake while operator shifts into third gear. Load is picked up again, without noticeable jerking, by gradually releasing the emergency brake as engine takes hold through the fluid coupling. Second gear is used near the end of an unusually heavy pull; low gear pulls slack slowly into manhole after cable arrives there.

More than 20 sections of cable have been pulled and pulling stresses as high as 26,500 lb have been experienced. Thus far, behavior of the new fluid-drive pulling equipment has been up to expectations, when used to install new or extract old cables.

Be thrifty - use the **I-50**

THERE'S LESS TO MAINTAIN!

With the I-50 watthour meter, all need for periodic replacement of bearings has been eliminated. Magnetic suspension of the rotating element eliminates all vertical pressure. Contrast this with a conventional meter, where pressure of the disk on the lower bearing is measured in tons per square inch.

Corrosion is eliminated by a combination of unit-molded base and stainless-steel cover- and socket-sealing rings. Accurately controlled relief gaps permit the I-50 to withstand voltage surges that would put an ordinary meter out of service.

Each complete electromagnet is a unit assembly, not subject to misalignment. This unit construction makes possible an economical service plan. A complete frame and electromagnet assembly can be exchanged for a rebuilt one—as a unit. Cost of the assembly is no more than the cost of just a single current coil for an older meter.

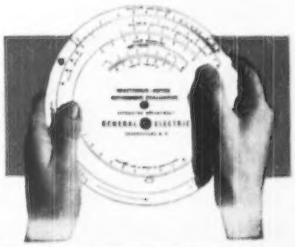
time to retire ... old watthour meters?

Meters of pre-1914 design should be retired promptly.

Meters of 1914-1925 design lose revenue at high loads, justify few or no repairs.

Meters of 1926-1936 design also require appraisal.

Now—with the aid of the retirement evaluator*—you can determine which groups of your meters are losing money and should be retired promptly. The evaluator is based on an economic formula for meter retirement developed by General Electric engineers. Ask your G-E representative for complete information. Apparatus Department, General Electric Company, Schenectady 5, N. Y.



*RETIREMENT EVALUATOR

GENERAL ELECTRIC

603-58

NEW! NEW! NEW! NEW! NEW!

250 AND 600 VOLT FUSES

INTERRUPT 100,000 AMP!

Type EJ-6 fuse rated 250 volts a-c, 30 amperes (actual size)

Section R 856-30
Apparatus Department
General Electric Company
Schenectady 5, New York

Please send me your bulletin, GET-1819, that describes the new Type EJ-6 Current-limiting Power Fuse.

Bulletin needed for: Reference purposes Planning immediate project

NAME _____
(Please Print)

POSITION _____

COMPANY _____

CITY _____ ZONE _____ STATE _____

...AND THEY'RE LISTED BY UNDERWRITERS' LABORATORIES

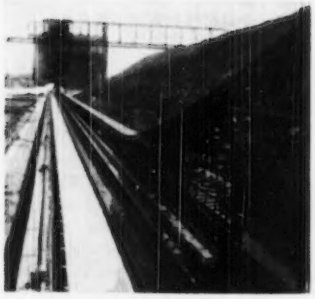
These new General Electric Type EJ-6 current-limiting power fuses are for application on 600-volt a-c (and below) circuits where the short-circuit current may reach 100,000 amperes. You get increased protection when you use EJ-6 fuses.

RATINGS Standard NECS size fuses are available in 30, 60, 100 and 200 ampere sizes in both 250- and 600-volt ratings. All ferrules and blades have silver surfaces to reduce contact losses. Fuses will interrupt 100,000 rms amperes total asymmetrical current including the d-c component of fault current.

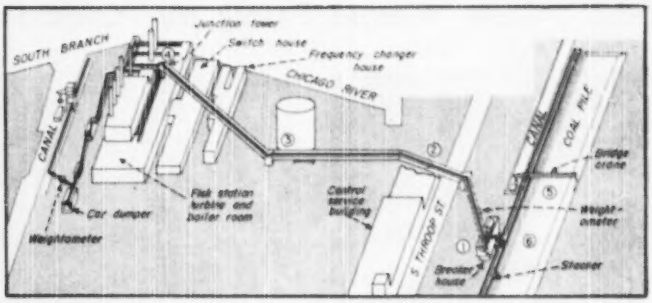
FUSE CLIPS The new EJ-6 fuses are designed to fit standard NECS fuse clips. Also available are special-design clips that prevent the insertion of other NECS fuses. Short-circuit stresses cannot jar fuses loose from these clips. Protect your equipment and personnel by allowing only fuses of high interrupting capacity to guard your circuits.

For additional information on these new fuses ask your G-E Sales Representative for a copy of publication GET-1819 or use the handy coupon. *Apparatus Dept., General Electric Co., Schenectady 5, New York.*

GENERAL ELECTRIC



COAL STORAGE facilities to serve additional capacity of Fisk Station hold 250,000 tons of coal. Traveling belt delivers coal to new ⅜-mile conveyor through breaker house, then partly underground to station



CONVEYOR SYSTEM carries coal ⅜ of a mile from storage pile to station. Conveyor runs underground from breaker house (1) to east side of street (2). Coal is transferred at junction point (3) from one belt to another. Conveyor changes slope at this point. At conveyor terminals (4) in junction tower above the station, an automatic coal sampler extract test sample every 40 sec. Inside conveyor structure is space for a second belt

Conveyor Belt Shovels Coal Three-Eighths of a Mile

RAPID EXPANSION of Fisk Station of Commonwealth Edison Co necessitated additional coal storage facilities and therefore prompted the building of a ⅜-mile coal conveyor system. This conveyor not only handles large quantities of coal conveniently and quickly but also eliminates the expensive method of reloading coal into barges and transporting it via canal and river to the station.

When the station was being expanded, additional coal storage area adjacent to the plant was not available. However, facilities for storing 250,000 tons of coal were provided on company property located ⅜ of a mile from the plant. Coal is delivered by barge to station site and to the new storage space. To get the coal to the station from the new storage space, the belt conveyor system was installed, following a direct route from storage space to station.

Starting beneath the breaker house, (1) in the drawing, the belt travels underground (dotted lines) until it reaches the west side of S. Throop St. There it changes direction and starts upward, emerging from the ground east of the street (2) and south of the company's central service building. From there it goes horizontally at an elevation of about 35 ft and then changes direction and slope (3), terminating above the station at the junction tower (4) 114 ft high.

Present equipment consists of only one belt traveling at 500 fpm and with carrying capacity of 800 tons per hr. Structural provisions have been made for installation of a second belt when required. Coal taken either from barge or the coal pile (5) is crushed in the breaker (6) and is then moved on the belt to the station.

Coal also can be taken from barges alongside the station or from storage adjacent to station, which sources supplied all requirements in the past. This assures continuous supply in case of shutdown trouble on the new conveyor.

Electrical Steel Gage for Silicon Steel Sheets

MAGNETIC STEEL sheets for manufacture of electrical equipment are available in various thicknesses indicated by the Electrical Steel Gage. The gage numbers and gage thicknesses in inches are given in the accompanying table. This table and text are an adaptation from an engineering manual of Carnegie-Illinois Steel Corp.

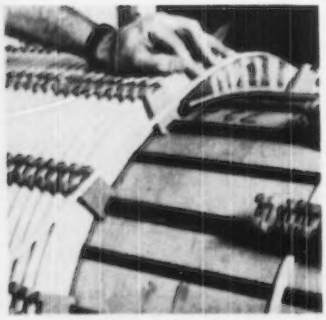
The Electrical Steel Gage is used for silicon content steel sheets. It differs from the U. S. Standard Gage for low carbon steel sheets. The U. S. Standard Gage is a weight-gage based on ounces per square foot; therefore sheet thickness for a given gage number varies inversely with the density of the material.

Electrical Sheet Gage for Silicon Steel

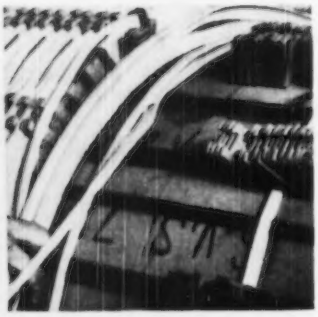
Gage No.	Gage Thickness (Inches)	Gage No.	Gage Thickness (Inches)
11	0.1250	22	0.0310
12	0.1090	23	0.0280
13	0.0940	24	0.0250
14	0.0780	25	0.0220
15	0.0700	26	0.0185
16	0.0625	27	0.0170
17	0.0560	28	0.0155
18	0.0500	29	0.0140
19	0.0435	30	0.0125
20	0.0375	31	0.0110
21	0.0340	32	0.0100

As the density of electrical sheet varies with the silicon content, it is not desirable to have the sheet thickness vary with silicon content to maintain a given weight per square foot for a given gage number. For this reason, the Electrical Steel Sheet Gage Table was evolved, to maintain a single thickness for a given gage number regardless of the silicon content. Furthermore, a maximum core loss can be established only for a definite sheet thickness.

Coils Wound Faster by "Outside-In" Technique

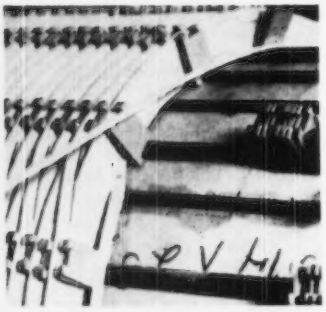


START of "outside-in" coil is a temporary coil wound in the conventional way



TOP TURN is now slipped off to become innermost turn of finished coil

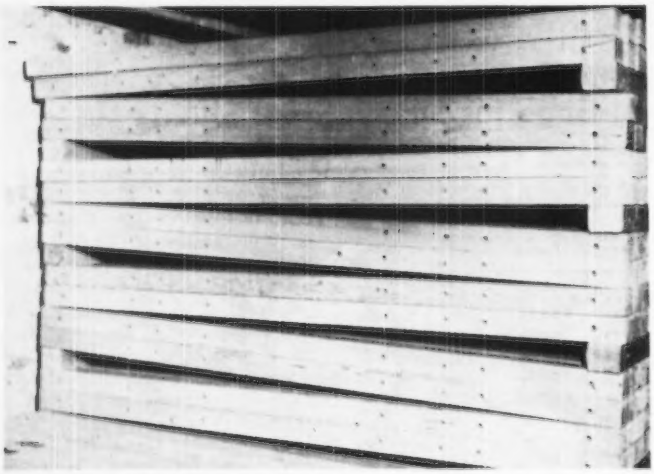
EACH TURN in succession is moved from temporary coil to final coil. Entire coil must be moved back flush with dividers to allow top turn to be put in place



FINISHED COIL is now firmly in place with crossover visible on top. Crossover to following coil is at bottom; thus following coil can be wound in normal fashion

TRANSFORMER COILS are wound easily and more efficiently by a winding technique developed by Westinghouse Electric Corp. This technique (1) eliminates the slow and awkward process of brazing connections between adjacent coils; (2) produces a more efficient (electrically) set of coils by elminating cross-overs which cut lines of force; (3) allows an entire set of coils to be wound from a continuous copper strip.

Known as the "continuous strap-wound pancake" or "outside-in" winding technique, this method is basically a simple operation. Each odd-numbered coil or "section" is wound in the conventional manner, from the inside out. For each even-numbered section, which conveys the copper strip from the outside to the inside, a "temporary" winding is made, also from the inside out. Then the various layers of wire thus built up are slipped off, one by one, and placed in reverse order on top of each other. When this is completed, the layer which, with its cross-over, was the first, or inside, layer of the temporary winding, becomes the final, outside layer of the permanent winding. This procedure is used for all strap-wound core-form transformers with ratings of 250 kva and up.



STACKING PLAN eliminates sweating, warping and cracking in crossarms not completely cured. Inventory time is reduced and stability of stack is insured by symmetrical plan

Crossarm Stacking Stops Sweating and Cracking

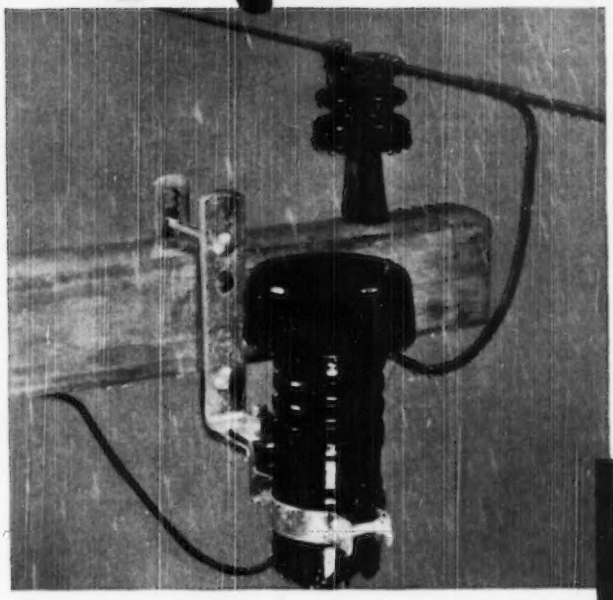
R. W. OSBORNE
General Storekeeper
El Paso Electric Co
El Paso

SWEATING, warping and cracking of crossarms not completely cured are prevented by this stacking method now being used by the El Paso Electric Co.

One crossarm is put across every other row, alternately at front and back of the stack. One side of crossarm is thus exposed to the air, aiding and utilizing free circulation through the stack. Symmetry of the arrangement means a big reduction in time spent compiling an inventory—cuts the time in half. Stability of the stack has been found to be excellent.

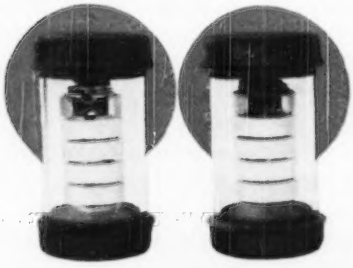
Moisture

doesn't hurt this arrester



The General Electric Pellet Arrester has a unique valve element that is unaffected by service moisture—and gap electrodes that are sealed in dry nitrogen (N_2)—exclusive features that mean more enduring protection against lightning.

Valve Element Unaffected by Service Moisture! Efficient valve element is a column of lead peroxide pellets—pellets which are actually formed *with water* in a tumbling barrel (right). Moisture in service causes no change whatever in the unexcelled protective characteristics of this pellet valve column.



N_2-filled Gap Excludes Corrosive Moisture! Here's life-test proof: electrodes at left were sealed in *dry nitrogen*—those at right sealed in *air*, and both exposed outdoors under maximum rated voltage. Result: N_2-protected gaps are bright and clean; gaps sealed in air are discolored and corroded.

In addition, pellet arresters use inorganic insulation throughout—no internal fiber to "track," carbonize or wear away. Whether valve- or expulsion-type, *no other distribution arrester is so unaffected by service moisture.* Write for Bulletin GEA-2975. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

Application of Insulating Materials For Conductors

Table lists properties of conductor insulation and of field pole protection for rotating machines, also of ground insulation for transformers

TABLE contains numerical values (in light type) wherever possible. Also a relative value (in bold-face type) of the property with respect to the other materials is assigned, based on a rating system. Rating of 1 indicates that the material designated is deemed most desirable for the property named. The accompanying ratings 1 to 10 are based on opinions reported by industrial users of these materials.

CONDUCTOR INSULATION (SINGLE AND MULTI-STRAND) FOR MACHINES

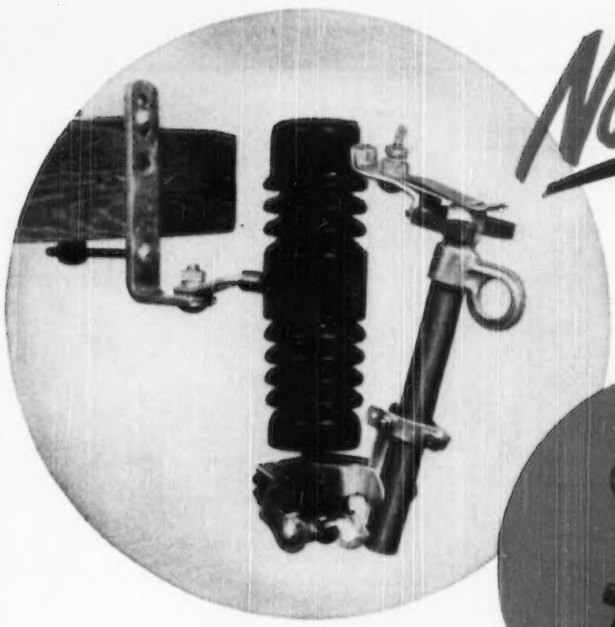
Material	Dielectric Strength, vpm	Thickness, mils	Abrasion (resistance to)	Flexure (life under)	Creasing (resistance to)	Tear (resistance to)	Handability	Tensile (Breaking) Strength, lb. in. width	Maximum Operating Temperature	Thermal Aging	Heat Conductivity	Resistance to				
												Moisture	Oil	Acid	Base	Solvent
Cotton																
Plain (1)	50-100	7.5 to 3.5	5	4	4	5	3	20	90 C	6	8	9	3	9	9	2
Conventional Varnish	1,000-1,400	4.5 to 6.0	6	4	4	6	3	40	105 C	6	8	7	4	9	9	4
Rayon																
Conventional Varnish		2.2 to 2.5	3	4	4	8	3	wrp. 25 fil. 25	105 C	5	8	3	3			6
Asbestos																
Plain (2)	50-100	41.0 to 46.0	8	3	5	7	8	wrp. 70 fil. 32.5	125 C	2	10	10	7	8		7
Glass																
Plain (3)	50-100	3.0 to 15.0	7	3	7	1	3	wrp. 135 to 440	300 C +	1	9	1	1	2	4	1
Conventional Varnish (2)	1,000-1,200	3.0 to 15.0	4	3	9	3	3	wrp. 70 to 400	130C (limited by binder)	4	7	1	1	2	4	1
Silicone Varnish (1)	1,200-1,500	3.0 to 15.0	5	4	9	4	3	wrp. 70 to 400	180 C	2	7	1	10	2	4	10
Mica																
Conventional Varnish (4)	500-1,000		3	9	10	2	8	70	180 C	2	7	4	2	6	9	3*
Inorganic Backing (5)																
1) Conventional Varnish (6)	900	6.0 to 9.0	5	4	9	3	5	70	130 C (limited by binder)	2	7	2	2	3	3	4
2) Silicone Varnish	600 (at 180 C)	6.0 to 9.0	5	4	9	3	5	70	180 C	2	9	2	10	5		9

FIELD POLE PROTECTION FOR MACHINES AND GROUND INSULATION FOR TRANSFORMERS

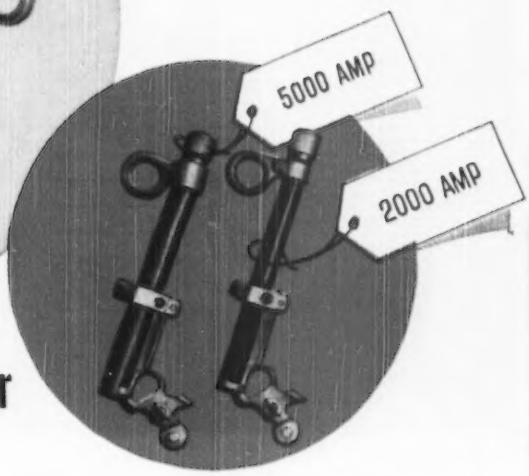
Material	Dielectric Strength, vpm	Thickness, mils	Abrasion (resistance to)	Flexure (life under)	Creasing (resistance to)	Tear (resistance to)	Tensile (Breaking) Strength, lb. in. width	Maximum Operating Temperature	Thermal Aging	Heat Conductivity	Resistance to				
											Moisture	Oil	Acid	Base	Solvent
Paper (7)	160	5.0	9	4	5	4	MD 250 CMD 260	105 C	7	5	8	4	9	9	4
Pressboard (8)		90.0													
Uncut Mica (9)	1,500		4	9	10			180 C	1	5	2	2	2	3	1
Mica															
Paper Backed															
Conventional Varnish		90.0	8	5	7	8		105 C	4	8	8	5	9		8
Glass Backed															
1) Silicone Varnish (6)	600 (at 180 C)		5	4	9	3		180 C	2	9	2	10	5		9
2) Conventional Varnish	900	90.0	5	4	9	3		130 C	2	7	2	2	3	3	4

* No resistance to alcohol. 1. Round and rectangular. 2. Cloth. 3. Tape. 4. Applied as tape to rectangular formed conductors. Segment mica shellac. 5. Applied as tape to rectangular formed conductors. 6. Basis for rating: 0.002 in. glass, 0.004 in. mica. 7. Kraft. 8. Acetate coated. 9. Block mica.

Adapted from "A Survey of Electrical Insulation Practices" by M. A. Faucett, C. Houpis and G. E. Leibinger; Circular Series No. 57, published by The Engineering Experiment Station, University of Illinois, Urbana, Ill.



Now! 5000-amp interrupting rating...



simply by changing fuseholder

General Electric 5.2-kv and 7.8-kv open-drop-out cutouts are now available with a 5000-ampere interrupting rating for high-capacity distribution circuits.

This new heavy-duty cutout is identical with the standard cutout (2000 amp interrupting rating) except for the fuseholder. Standard cutouts already in service can be converted to the heavy-duty rating in a matter of seconds—simply by changing the fuseholders. The same fuseholder is used on either 5.2-kv or 7.8-kv cutouts.

G-E ADVANCED DESIGN ALSO GIVES YOU

GREATER ELECTRICAL CLEARANCE—NO UNNECESSARY FUSE BLOWING Electrical clearances are increased by solid porcelain insulator with cemented-in supports instead of troublesome metal clamps. Mounting support is on *opposite side* of porcelain from all live parts, preventing birds and animals from bridging the insulator and blowing fuses.

INSULATOR PROTECTED AGAINST STRESSES DURING RECOIL Because fuseholder is close-coupled to insulator, recoil force of fuseholder is directed along center axis of porcelain, greatly reducing stresses in porcelain. Shock absorbers prevent impact from being transmitted directly to porcelain.

CONTACTS PROTECTED FROM CORROSION Silver-plated contacts are shielded from weather and protected by factory-applied grease which seals out dirt and prevents oxidation. Hinge guides steer fuseholder into upper contacts and prevent contacts from shifting during wind or pole vibration. The same clean areas on the contacts come together each time, keeping contact resistance low and preventing overheating.

Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

Wood Pole Inspection Chart

Chart gives load, class, replacement circumference and reinforcement — adapted from overhead construction standards of New England Electric System

Table I – Wire equivalents for scales 1 & 3

Description, wire or cable	Wire equiv.	
	Power scale 1	"X" scales
Power wire up to 2/0 TBWP	1	
Aerial power cable	4	
Power wire 4/0 TBWP	1.2	
Power wire 500 Mcm and larger	1.5	
Head guy	1	
Telephone cable all sizes		"X"
Twisted pairs in rings		"X"

Table II – Equivalent load units for scale 6

Description of attachment	Equiv. W.L.U.* (100 lb) Scale 6
Street light bracket	1
Transformer	1
Service wires and cables One side only, each wire each cable	1 2
Both sides, subtract the number of wires on the larger side from twice the number of wires on the smaller side, if the result is positive go down the scale that many spaces, if negative go up Note: Each cable equals 2 wires	

* Wire load unit

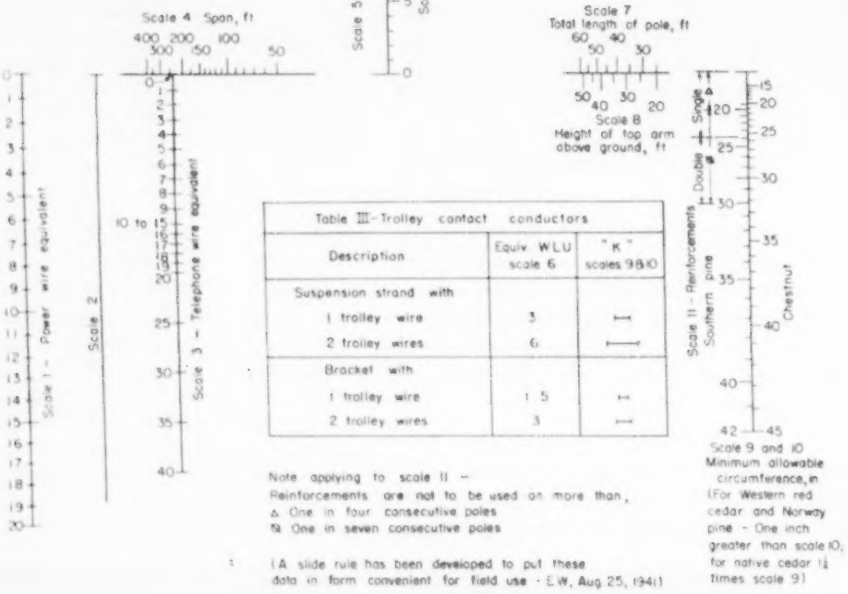

Scale 4 Span, ft
400 300 200 150 100 50
Scale 5 – Class of full length treated pole (New)
Scale 6 – Wire load unit at top of pole
Scale 7
Total length of pole, ft
60 50 40 30
Scale 8
Height of top arm above ground, ft
50 40 30 20
Scale 1 – Power wire equivalent
Scale 2
Scale 3 – Telephone wire equivalent
10 to 15
Single
Double
Scale 11 – Reinforcements
Southern pine
Chestnut
Scale 9 and 10
Minimum allowable circumference, in

Table III – Trolley contact conductors

Description	Equiv. W.L.U. scale 6	"K" scales 9 & 10
Suspension strand with		
1 trolley wire	3	
2 trolley wires	6	
Bracket with		
1 trolley wire	1.5	
2 trolley wires	3	

Note applying to scale 11 –
Reinforcements are not to be used on more than,
Δ One in four consecutive poles
‡ One in seven consecutive poles

(For Western red cedar and Norway pine – One inch greater than scale 10, for native cedar 1¼ times scale 9)

(A slide rule has been developed to put these data in form convenient for field use – E.W. Aug. 25, 1941)

INSTRUCTIONS for use of chart will be published in Engineering Reference Sheet 50-40 on Oct 9, 1950

Helping Hands for a Man Driving a Million Horses

JUDGING by the experience of some of the country's biggest utilities, the system operator of a power interconnection can invariably do a better job of dispatching power economically when he's assisted by L&N Load-Frequency Control. For this equipment brings full control of the system's thousands of kilowatts of generating capacity right at the operator's finger-tips—helps him in several specific ways:

1. It gives him the information he needs to make decisions on load distribution—without need for reliance on telephone communications. System generation, system load, net interchange, frequency and various sub-totals are automatically recorded in detail to show trends as well as instantaneous values.

2. It automatically does a big share of the load-dispatching job for him, while still leaving overall operation under the operator's supervision. Selector switches enable the operator to choose the type of control action best suited to the system's operating conditions at any moment.

3. It can accomplish control action that would be extremely difficult for an operator to duplicate. Under tie line bias control—the type most widely used on modern interconnections—the equipment watches frequency and tie line load simultaneously, and gives directions to increase or decrease generation so as to hold both of these variables within scheduled values.

4. It saves a lot of time, both in routine operation and in emergencies, because generation changes are initiated automatically in rapid response to the need.

Now in operation in systems totalling over 40 million kilowatts capacity, L&N Load-Frequency Control is engineered to meet the requirements of any utility, either isolated or interconnected. We'll be glad to send you details in our newly revised Technical Publication ND4-56-461(1). Write to Leeds & Northrup Company, 4938 Stenton Ave., Philadelphia 44, Pa.

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LEEDS & NORTHRUP CO.

Jrl Ad ND44-56-461(3)

Check High Bill Complaints with Portable Meter

EARL H. BROCKWAY
Supervisor, Electric Meter Dept
Consumers Power Co
Flint, Michigan

INVESTIGATIONS made for customers who complain of an unusual increase in their electric bills can be carried out satisfactorily using a portable kwhr check meter. With the meter installed on the electric range, water heater, or other household appliance, the customer can see for herself the rate of use and readily determine the cost of operation.

The check meter was made from readily obtainable parts, most of which are carried in our regular storeroom supplies. The enclosure is an indoor socket type meter trough, on one side of which is mounted a standard electric range receptacle, and on the other a range cable connecting plug. Two flat pieces of cross arm brace screwed to the bottom hold the device in a firm up-right position. A metal handle is mounted on the top for easy carrying.

A 220-v, socket type, three-wire meter is mounted on the trough and sealed. If desirable, a cyclometer type register can be installed on the meter for easy reading. Check meters are also made for 120-v, two-wire service for investigating small appliance loads.

PORTABLE KWHR check meter can be attached directly to range (or other household appliance) to show actual rate of energy consumption to customers who complain of unusual increases in electric bill. Meter was made from parts normally stocked in storeroom

Expand Board Easily With Sliding Panel

JOSEPH A. GERBER
Substation Design Section
Bonneville Power Administration

SLIDING PANELS will provide additional metering space without disturbing the rest of a new system dispatching board in the J. D. Ross substation of Bonneville Power Administration. Most of the board area is occupied by the system diagram, which is split in the middle to form two sections. Between these sections are four steel panels mounting graphic recording meters, each 24 in. wide panel being removable from the rear.

As additional recorder panels are needed, spare steel panels which are

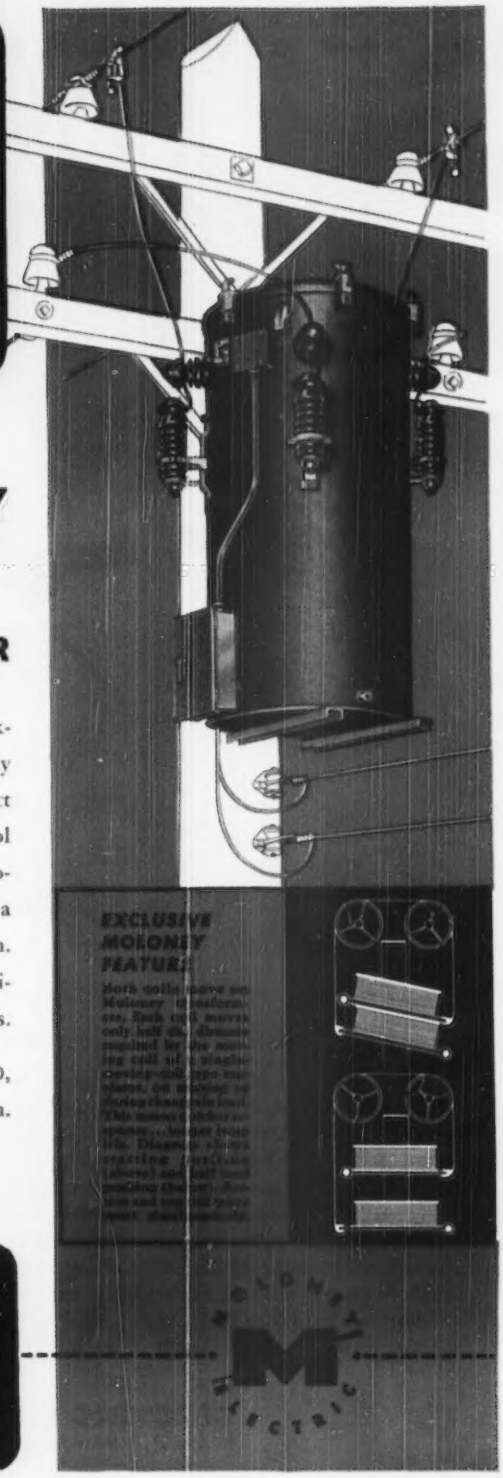
Bonneville Power Administration photo

SLIDING PANELS make up this system dispatching board of Bonneville Power Administration at J. D. Ross substation, near Vancouver, Wash. Blank panels at the end can be removed and the system diagram easily moved along the arc of the board, leaving room for installation of additional recording instruments in the center

Cut Installation Costs ... Save 2/3 of Installation Time ... Improve Appearance

WITH

THE NEW MOLONEY "packaged-unit" CONSTANT CURRENT TRANSFORMER



Save time and money with the new Moloney "Packaged-Unit" Constant Current Transformers. Simply hang the "Packaged-Unit" on the pole . . . connect primary and secondary leads . . . connect the control line . . . *and that's all!* Comes complete with all protective and control equipment incorporated as a part of the transformer to permit unit installation. No separate installations of lightning arrestors, primary fuse cutouts, oil switches or protective relays.

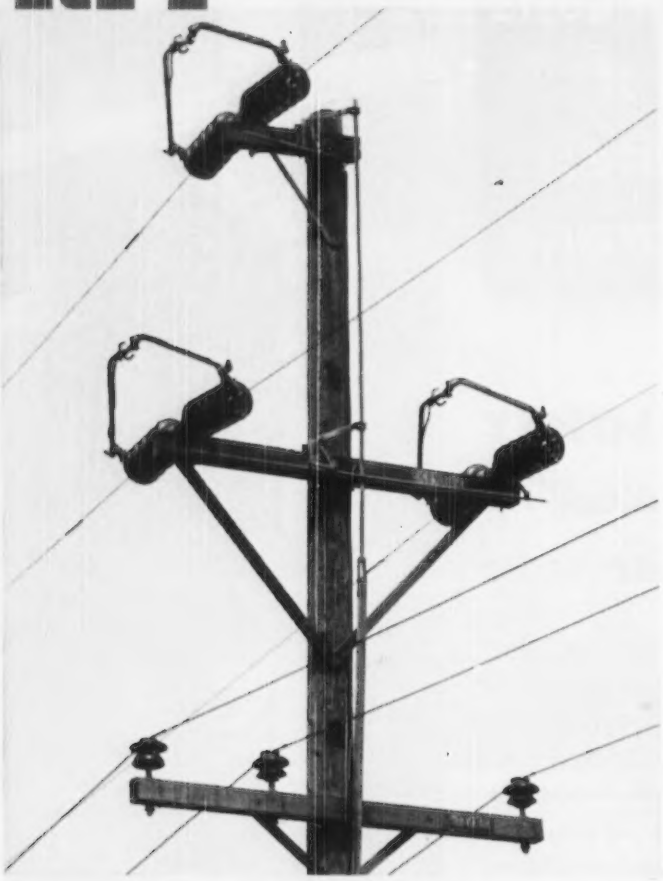
Write today to Moloney Electric Co., St. Louis 20, Mo., for Bulletin SL-702 giving complete information.

Sales offices in all principal cities

MEEO-4

MOLONEY
ELECTRIC COMPANY
FACTORIES AT ST. LOUIS 20, MO.
AND TORONTO, ONTARIO, CANADA

KPF POLE TOP SWITCHES



Simple design means economical installation

Bore two holes in a single crossarm, tighten two bolts, attach the conductors, and the switch is installed! No separate dead-ends, no "extra" insulators required. Saves man hours, saves installation costs.

Simple design also means lower first cost, less maintenance. Insulator stacks are readily adjustable for line sag. Free-floating, self-aligning, silver-surfaced blades and jaws maintain proper contact under all conditions of sag adjustment. Switches can be used in vertical, horizontal or triangular mountings. The low-cost, trouble-free service rendered by KPF switches is attested by the many thousands in use throughout the world.

KPF ELECTRIC COMPANY
857 Howard Street • San Francisco 3, Calif.

now at the extreme ends of the board will be removed and installed adjacent to the existing recorder panels. The extra space required will be provided by sliding the system diagram sections to the right and left.

System diagram panels are each 20 ft long and are made of a plywood back, a layer of sound deadening insulation batting, and a front faced with ⅛-in. thick perforated Masonite. Panels are not fastened to the floor or the ceiling in any way, but rest on the floor and are kept in place by small wood mouldings fastened to the floor and to the ceiling. Mouldings also act as guides for sliding the panels along the floor. Graphite on the rubbing surfaces and pulling eyes on the rear side of the panels facilitate sliding.

Simplicity in revising the diagram on the board as rapidly as system changes occur is assured by using removable, non-glossy, colored adhesive tapes for lines and symbols. Numbers and letters are pre-cut gummed paper, dampened and cemented to the board with rubber cement. The $\frac{7}{32}$-in. spacing of the 0.055-in. holes in the masonite is used as a module in laying out and aligning characters, lines, lettering, and symbols. The holes also hold the stems of colored plastic plugs to indicate switch positions. This eliminates any need for large holes in the board, which are difficult to cover neatly when the diagram is changed.

Length of the board, which is built on a circular arc of 24-ft radius, is 60 ft, and it extends nearly 11 ft from floor to ceiling. Indirect incandescent lighting of the flat green color, especially developed to provide maximum visibility of the colored tapes, gives restful glare-free lighting over the entire board area.

Lamps Protect Spillways From Ice Pressure

S. S. SQUARE
Supt, Power Plants
City of Winnipeg Hydro Electric System
Pointe du Bois, Manitoba

For over 25 years lamp boxes have been used successfully to keep an open channel in front of spillway piers and flashboards to protect them from ice pressure. These boxes have proved effective on ice up to 3 ft thick

the "Dutch Brand" trio... THREE ELECTRICAL TAPES

Not one... but all three!

ALL THREE TAPES ARE IMPORTANT TO MEET THE SPECIFICATIONS of the ELECTRICAL TRADE

"DUTCH BRAND" PLASTIX Friction and Rubber Tapes

No one tape can fulfill the requirements of all jobs . . . it takes the three basic insulating tapes DUTCH BRAND PLASTIX, Friction and Rubber . . . each with different properties . . . to meet the specifications of the electrical field. DUTCH BRAND offers a complete line so that selection can be made.

"DUTCH BRAND" insulating tapes have been well known for forty years as quality tapes, and you can select and depend upon any of them to meet specifications.

They are available at your jobber's.

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Manufacturers of Rubber Products . . . Est. 1910

CHICAGO 19, U. S. A.

THE MOST COMPLETE LINE

- BRONZE BUS SUPPORTS FOR USE WITH COPPER CONDUCTORS
- ALUMINUM BUS SUPPORTS FOR USE WITH ALUMINUM CONDUCTORS
- *Available with and without insulators*

Anderson Brass has made a specialty of assisting with solving "tough" substation bus support and connector problems. This specialty transcends all phases of electrical, mechanical and metallurgical problems.

With more than two decades of specialized electrical, mechanical and metallurgical experience in the engineering and manufacture of bus supports, fittings and connectors we are qualified to assist in improving your substation's dependability and circuit security with no extra cost. This type of service is at your disposal from Anderson Brass. We welcome the "tough" problems as well as the "easy" ones.

Consult one of our nearest 19 representatives or contact our main office.

Write today for Catalog No. 205—Outdoor Bus Supports and Fittings. Information on aluminum bus supports and fittings available on request.

ANDERSON BRASS WORKS, INC.

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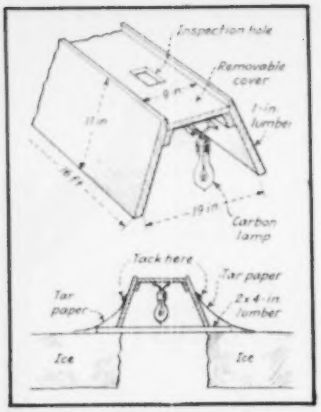
BIRMINGHAM, 1, ALABAMA

• BRONZE AND ALUMINUM POWER CONNECTORS, FITTINGS, AND BUS SUPPORTS
ALUMINUM SUSPENSION AND STRAIN CLAMPS



LAMP BOXES are placed over slot as soon as ice is strong enough to walk on. Tar paper keeps snow from falling into slot

SLOT IN ICE to protect spillway pier has been kept open by lamp boxes in ice 3 ft thick and during —45 F weather

and in temperatures as low as —45 F. This method has also been used to prevent ice formations around seal posts on headgates and on upstream sides of unheated sluice gates.

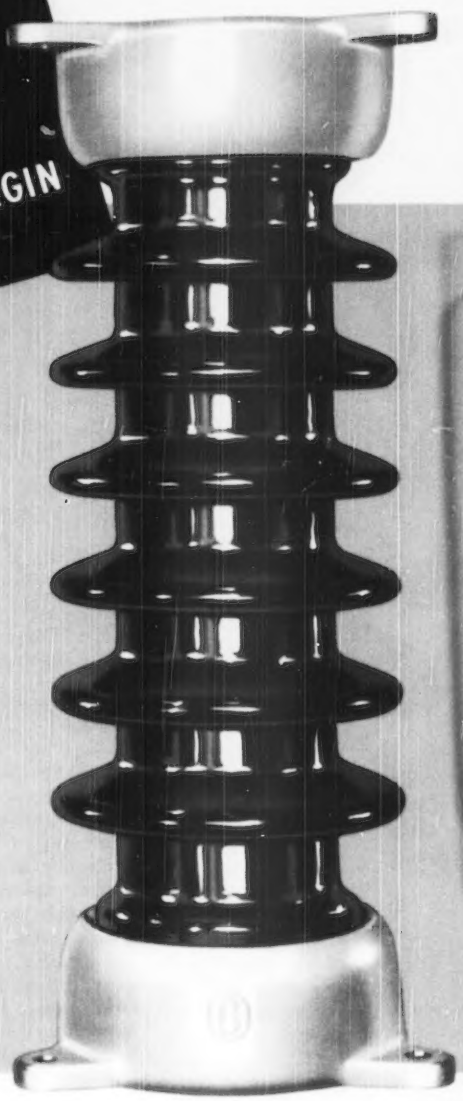
As soon as ice is strong enough to stand on, a slot is cut in the ice about 20 in. wide and about 8 ft out from piers. Two pieces of 2x4-in. lumber are placed across the open slot about 10 ft apart. A lamp box (see illustrations) is then placed on the lumber.

Strips of tar paper are tacked along sides of boxes and left resting on the ice to prevent snow from falling into the slot and slushing. Snow is piled over the boxes, the more the better, as this prevents the heat from escaping.

Carbon filament, 16-cp, 120-v lamps are spaced about 12 in. apart

HI-TENSION NEWS *Junior*

CLOSE TOLERANCES IN THOREX ARRESTERS OFFER IMPROVED PROTECTIVE MARGIN



To assure the extremely close operating tolerances offered in the new O-B Thorex lightning arrester, factory production must be somewhat better than published values. To guarantee an IR discharge voltage not exceeding +5% and a sparkover voltage not exceeding +10% in a mass-produced item requires daily manufacturing performance well within these outside permissible allowances. Hence, two important words precede O-B's tolerance statement: "Less than . . ."

What is this really worth? The low average discharge rating of Thorex arresters, coupled with a tolerance of less than +5%, and the rapid sparkover with less than +10% tolerance, provide a new low level of apparatus insulation protection. You can take advantage of such protection by specifying O-B Thorex arresters on both old and new apparatus. The Thorex brings to the American market the minimum values of protective characteristic tolerance so far offered. Minimum tolerance added to low average values of sparkover and IR discharge voltage, spell improved protective margin.

This is only one phase of the story behind the new O-B Thorex valve type lightning arrester. A new book, Publication 869-H, describes the Thorex in detail. Write for a copy or contact your O-B representative who will gladly supply any information you require.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*

THERE'S NO BETTER REASON THAN 25 YEARS OF EXPERIENCE FOR MAKING O-B THE

Choice of Insulators

Both these lines - - the 110-kv transmission and 44-kv distribution - - were built by a large Southern utility 25 years ago with O-B insulators. Both are operating today just as efficiently as when new, a quarter-century ago . . . Many more lines have been put into service in later years by this power company, completely O-B-equipped, for the best reason anyone can give - - first-hand experience . . . You can duplicate this performance on your own lines simply by making O-B *your* CHOICE OF INSULATORS.

Let's talk a little sense

ABOUT LINE POSTS

Most important thing about a line post is *not* its cylindrical shape or the special characteristics this shape produces. The Number One thing to remember is that a line post is *an insulator*. Whatever its features may be, these must be in addition to its insulating qualities.

Building insulators -- and building them right -- has been O-B's single purpose for over 60 years. Out of this has come some very realistic attitudes regarding manufacture. One of these relates to factory proof-testing.

O-B tests the porcelain column before assembly into line posts, individually, under three minutes of continuous 60-cycle flashover. Electrodes extend the full internal length so that the vital head section is under stress. If a specimen fails in this time, it is removed and the test is resumed for another three minutes until the entire group has withstood maximum voltage for the specified time without interruption. This conservative testing was established years ago for suspension discs, pintype and station insulator parts, as well as bushing components. O-B's fine service records have proved its adequacy and made it a "must" for every O-B insulator.

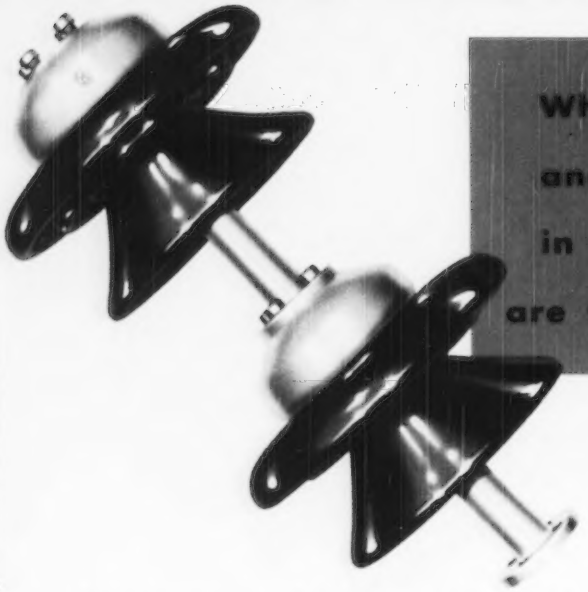
We know what it takes to make a good insulator, including a post, and we know what it takes to prove it on the testing bench. And we likewise take the attitude that a post is first and foremost an insulator -- not merely a shape.

If line posts are your standard, you cannot buy more honest security than that which O-B posts will deliver.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*



What you *BUY*... and what you *USE* in a station insulator are two different things!

Station insulator specifications are so complete and so rigid that all reputable makes are practical duplicates at one time in their life -- when new! But they stop being new the day they go into service. Then what do the specifications say? Nothing -- You can't specify performance, or life, or reliability. You *buy* the specifications, but you *use* the integrity of the manufacturer.

You don't really know how good a station insulator is the first day of its life. You find this out the last day.

How far away is this last day? We can't answer that question about O-B, but we do know that well over 30 years haven't produced that fatal day for thousands of O-B veterans on stations throughout the country. The thing these power companies really wanted when they bought O-B 30 years ago, they got!

Granted, you must have a standard insulator. That's easy -- you'd have trouble finding anything else. But this is the minimum requirement. The service and reliability that spells freedom from trouble is something you want still more and its a lot harder to be sure of in a *new* insulator. But, when you buy O-B station insulators, you get it -- the facts exist to prove this!

Ohio Brass

MANSFIELD, OHIO, U.S.A.

3046-H

along the underside top of the boxes. Carbon lamps have been found to be much more rugged than tungsten lamps, produce more heat for a given rating and have a longer life. Should one or two lamps burn out, there is little change in efficiency if they are replaced within two or three days.

If there is not more than a foot change in water elevation, little is required to be done except to inspect for burnt out lamps. Should the water rise 2 or 3 ft, it is sometimes necessary to re-align several boxes.

This past winter there were 160 boxes in service from Dec. 15 to March 1, protecting about 2,500 ft of spillway. Lamps were turned on for 24 hr per day during this period, after which they were only turned on a few hours per day as required, until boxes were removed on April 7. However, during any ice season, length of time boxes are in service depends entirely on weather conditions.

WALKING STICK for measuring line extensions is demonstrated by Darwin Lueck, who developed it. The device measures 5 ft across the bottom of the legs

"Walking Stick" Saves Helper's Time

TIME of a helper is saved by a "walking stick", developed by Darwin Lueck of the Kansas Power & Light Co for use in measuring line extensions. Instead of using a tape measure, which requires a man at both ends, Lueck walks along with his "walking stick" which measures 5 ft every time he turns it.

The idea is particularly valuable in outlying offices where, frequently, a helper is not available.

YOU CAN

DEPEND ON BARTLETT

for your Line Clearance work

DEPENDABILITY . . . that's why more and more utilities call upon Bartlett. "We want to deal with a strong, reliable organization that has the right equipment, adequate facilities no matter how big the job, and thoroughly trained men who have the 'know-how' to get the work done right and on time. We prefer a company nationally-known for ability. It's *good business* and *good customer relations.*"

FOR over 40 years Bartlett has provided up-to-date tree service based on scientific research. Bartlett men know and appreciate community problems; they make friends for you. Make your next job a Bartlett job and see the difference. Just call our local office in your community.

BARTLETT SERVICE MEANS

- CLOSE SUPERVISION
- TRAINED MEN
- BEST EQUIPMENT
- CAREFUL WORK
- PROMPT SERVICE
- ECONOMY
- RESPONSIBILITY

BARTLETT

TREE EXPERTS

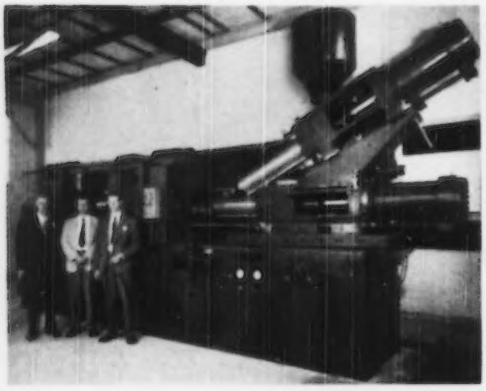
The Bartlett Way

HOME OFFICE: RESEARCH LABORATORIES & EXPERIMENTAL GROUNDS, STAMFORD, CONN.

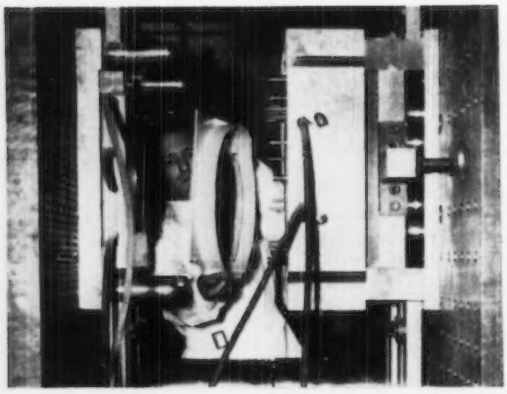
LOCAL OFFICES: Rutland, Windsor, Vt.; Milford, Peterboro, Rochester, N. H.; Cambridge, Framingham, Manchester, Osterville, Pittsfield, Mass.; Providence, R. I.; Danbury, Hartford, New Canaan, New Haven, Stamford, Westport, Conn.; Islip, Kingston, Monroe, Middletown, New York, Peekskill, Southampton, Syracuse, Westbury, White Plains, N. Y.; Bernardsville, Morristown, Orange, N. J.; Chambersburg, Paoli, Philadelphia (Cynwyd), York, Pa.; Wilmington, Del.; Bethesda, Easton, Towson, Md.; Ashland, Ky.; Lancaster, Portsmouth, Ohio; Charlottesville, Lynchburg, Roanoke, Va.; Bluefield, Charleston, Huntington, W. Va.; Kingsport, Tenn.

LOAD BUILDING

RESIDENTIAL • RURAL
COMMERCIAL • INDUSTRIAL



ALL-ELECTRIC plastic molding machine presses out large plastic products up to 200 oz in weight. Machine has 29 kw in resistance units and is powered by two motors rated 10 and 50 hp



MASKING FRAME for 16-in. TV tube is removed from machine. In addition to this 38-oz frame, the machine turns out such large items as cabinet doors, outdoor signs and desk drawer sections

Largest Plastic Molding Machine has 200-Oz Capacity

ELECTRICAL ENGINEERING IN INDUSTRY

WM. S. DeHAVEN
Power Sales Engineer
Atlantic City Electric Co
Inland Division

CLAIMED to be the world's largest injection molding machine, the A. L. Hyde Plastics Co, Grenloch, N. J., has installed an all-electric machine which presses out 200-oz of thermo-plastic products at one time. Previously, a 60-oz machine was considered large.

Television and radio cabinets, refrigerator door linings, kitchen cabinet doors, cabinets for room air conditioning units, washing machine agitators and tubs, drawer sections for desks and furniture, outdoor signs for service stations, oil companies, etc, are all examples of the large size products that now may be made by this piece of equipment.

The press is all-electric in operation, having one 50-hp motor and one 10-hp motor for the clamping and holding processes. A novel feature of this press is that it is equipped with a separate pre-plasticizing cylinder. This greatly speeds up operation of the press as the main injection cylinder is loaded automatically by the pre-plasticizing cylinder while the product is curing. Upon removal of the product, the main cylinder is ready immediately to reload the dies with pre-plasticized material.

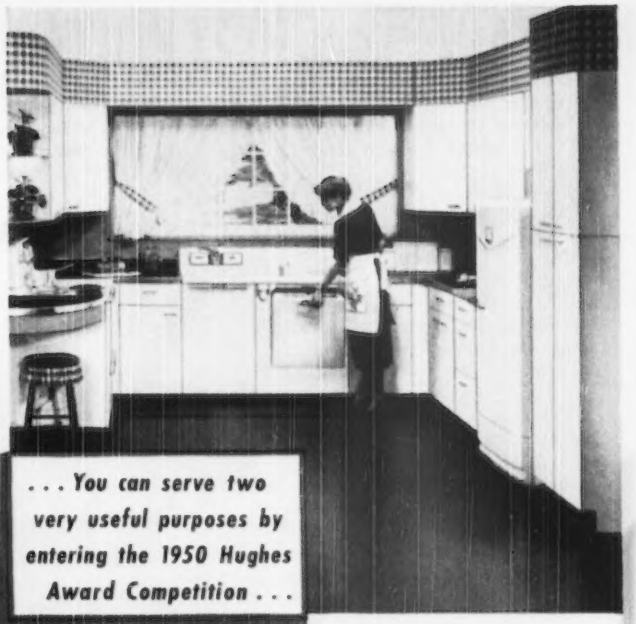
Electric heat from resistance units built into the press keeps the plastic at proper temperatures through completely automatic controls. Total resistance load of 29-kw is installed in the two cylinders. Reduced voltage starters and a capacitor installation assure smooth electrical operation at unity power factor.

Operations at the Hyde plant are conducted on a 24-hr day schedule, seven days a week.

Boston Edison Continues Range Promotion Campaign

BOSTON Edison Company's free wiring campaign to stimulate electric range sales ended June 30, but a promotional incentive became effective the next day. In place of the free wiring the company will now reimburse up to $40 to a customer placing an electric range in his premises, using scheduled rates. The capacity of the range must be 5 kw or over, with thermostatically-controlled oven and a minimum of three surface units and other features approved by the utility. The range must be the main cooking device in a permanent residence. Summer camps or temporary dwellings are not eligible for reimbursement. Inspection of the installation by the company and local municipal authority also is required. After the customer has completed arrangements for the entire wiring transaction with a local contractor, he sends the Edison company a written request for

YOUR Sales Idea CAN WIN A 1950 Hughes Award



. . . You can serve two very useful purposes by entering the 1950 Hughes Award Competition . . .

. . . Bring Electrical Living to More American Homes . . .

. . . Win a prize in the 1950 Hughes Award Competition . . .

Bringing electrical living to more American homes is, of course, the idea back of the Hughes Award Competition. How your utility company best accomplishes this is the basis for the Hughes Awards.

The size of your company or the conditions in the territory you serve will have no bearing on the decision of the judges. Likewise, elaborately prepared entries will have no advantage over simple, documented case-histories of successful sales programs.

The winners will be individuals and utility companies submitting successful sales methods, new or old, which have proved effective in solving a major appliance merchandising problem in their area.

Arrange now to enter the 1950 Hughes Award Competition. Write to Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y., for 1950 Hughes Award Booklets.

UTILITY DIVISION

Hotpoint Inc.

(A General Electric Affiliate)

5600 West Taylor Street, Chicago 44, Illinois

reimbursement on a standard form.

Over 11,000 electric ranges have been connected to the company's lines in the past 18 months. This represents an increase of nearly one-third in the number of electric range users. In the week ended June 17, 1950, 376 ranges were added to the system and since Jan. 1, 1950 to June 24, 4,245 ranges had been connected. Electrical appliance dealers (there are 600 in the company's territory) sold about 80% of the ranges connected to the system in the past year. The campaign began about two years ago.

Trolley Busway Makes TV Studio Lights Mobile

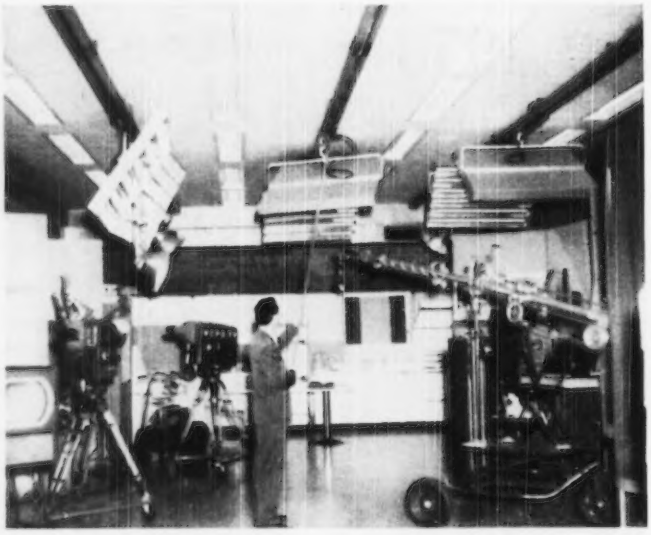
CINCINNATI'S television studio, WCPO, has solved the problem of making fast, frequent and smooth rearrangement of the lighting effects in its studios by using overhead electric power busway.

This new installation replaces an old arrangement of portable stand-type spotlights, wall-mounted baby lights, and ceiling mounted lights. It does away with long extension cords and cables which formerly cluttered the floors and made it necessary to hide and camouflage lamp cords where they might be visible. Caution had to be exercised to keep them from tripping actors, cameramen and technicians. The busway has increased the effectiveness of the lighting and speeded the re-arrangement of the lighting fixtures, as backdrops are changed.

The system consists of three 50 ft runs of busways, suspended in parallel, lengthwise in the studio to provide the power supply. Fluorescent television lighting units, theatre-type spotlights and floodlights, and baby spotlights are hung from specially designed trolleys and each unit is provided with a universal type joint to permit rotation of the unit either horizontally or vertically. Each 10-ft section of busway is isolated electrically from the adjacent section and fed by separate circuits which are controlled from a 30-circuit circuit breaker panel in the control room. This is to permit turning lamps off or on during the course of a program and also to allow presetting of lights for other sets so that programs can be changed without delay during the short time interval allowed for commercials. The separate circuiting method permits turning off all lights with the exception of those in immediate use. Still it allows immediate illumination of a set when required. Lights are moved and adjusted with hooksticks from the floor.

The new system provides maximum lighting efficiency and flexibility. By simplifying illumination problems, it makes it possible to light the studio in such a manner as to provide the highest quality in TV broadcasts at the same time permitting the use of expensive TV equipment at its maximum efficiency.

Grant Makinson, chief engineer for WCPO-TV, has devised a counter balanced elevator type floodlight hung from a trolley. It can be raised or lowered to any elevation from floor to ceiling with a gentle touch and yet will remain at any desired elevation. With this device unusual lighting effects can be achieved and the hard to light corners can be illuminated in the proper manner.



The Trumbull Electric Mfg Co photo

TROLLEY BUSWAYS suspended lengthwise from TV studio ceiling provide complete flexibility of lighting effects. Each light has a universal joint and is suspended from trolley. Lights are moved and adjusted with hooksticks from the floor

Load Building Notes

• Energy use by the average television set amounts to 366.5 kwhr per year. The average radio uses 120 kwhr. Since television replaces radio, the net increase resulting from television is 246.5 kwhr annually for the average set. These figures come from a study of television load made by the Detroit Edison Co. The study was reported in a paper by Fred A. Compton at the EEI sales conference in the spring of 1949. Since then more data have been accumulated. They indicate further that the 1949 figure of 220 kwhr average annual use should be revised up to the 246.5 kwhr here stated.

• Fatal night traffic accidents have been completely eliminated on thoroughfares in 11 cities where and since modern street lighting has been installed, according to the Street and Traffic Safety Bureau in a July news release. In 7 other cities fatalities were reduced from 65 to 93%.

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.

Tapping rubber from one of the millions of trees on U. S. Rubber's giant plantations in Malaya.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables · Street Lighting · Royal Cords · Network Cables · Utility Control · Pole & Bracket Cable · Service Entrance · Weatherproof · Zip Cord Pole Fixture Cable · Sup. Control

RAILROADS: Power Cables · Communications · Railway Signal · Royal Cords · Welding Cable · Railway Utility · Sup. Control · Weatherproof

HEAVY INDUSTRY: Power Cable · Royal Cords · Welding Cables · Control Cables · Machine Tool Wire · Building Wire · Switchboard Wire · Thermostat Cable · Bus Drop Cable

Absolute Tops in OZONE MOISTURE HEAT Resistance

U. S. RUBBER'S BUTYL-INSULATED POWER CABLES

These cables are for use on power distribution, street lighting and station control circuits and for general-purpose wiring on circuits up to 8000 volts between phases and at conductor temperatures up to 80 C. The insulation will not crack after four hours in air containing 0.015 per cent ozone. They are light in weight, easy to install and join, and are resistant to oil, heat, sunlight, flame, acids, alkalies and corrosive chemicals. The following are guaranteed test values:

PHYSICAL AND AGING PROPERTIES (MINIMUM VALUES)

	Butyl Insulation			Neoprene Jacket	
	Unaged	After 168 Hrs. in O.B. at 80 C.	After 7 Days in Air Oven at 250 F.	Unaged	After 96 Hrs. in O.B. at 70 C.
Tensile, lbs. per sq. in.	600	500	400	1800	1600
Elongation, per cent	400	350	350	300	250

MOISTURE RESISTANCE (MAXIMUM VALUES)

a. Dielectric constant and power factor of insulation after immersion in water at 50 C.

Dielectric constant, one day	4.0
Per cent gain, 1 to 14 days	2.0
Per cent gain, 7 to 14 days	1.0
Power factor, one day, per cent	2.0

b. Mgs. per sq. in., 7 days at 70 C. 15.0

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPT. • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

Ask the men who climb 'em!
Ask the men who have to climb the poles how much it means to them to have those poles *clean*—Penta treated. Or ask yourself. Wouldn't you rather work on a clean pole instead of one with an odor that would cling to your clothes? Pentachlorophenol long ago outdated the idea that preservative treatment had to mean sticky poles. Penta Preservative, containing pentachlorophenol, leaves poles clean, yet provides an equal or better protection than other treatments. That's why linemen prefer Penta treatment to any other.
Toxicity of pentachlorophenol to decay and termites is well known. No other commonly used preservative can beat its records. And you're sure with Penta—it is a chemical entity that cannot vary in its make-up (and so its effectiveness) from one time to another.
Treatment with Penta Preservative costs about the same as other preservatives, and will prove an asset in your labor relations. Ask us for any convincing facts or figures you'd like to have. We're ready and eager to give them to you.
CHAPMAN CHEMICAL COMPANY
757 DERMON BUILDING • MEMPHIS 3, TENNESSEE
CHAPMAN
• IT'S CERTAIN • IT'S CLEAN •
IT'S CLEAN
PENTA
PRESERVATIVE
IT'S CERTAIN
• IT'S CERTAIN • IT'S CLEAN •

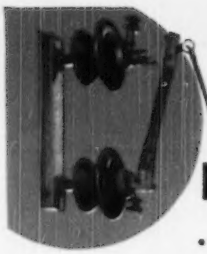
INDUSTRIAL BRIEFS

Immersion Heaters save time, eliminate expensive repairs and provide maximum machine usage at the Ex-Cell Coal Co at Lumberport, W. Va. A coal washing machine is used 8 hr daily in an uninsulated building. In winter months there is danger of the water freezing and damaging machine or machine must be drained and refilled each day at considerable time cost. Gas or steam heat would cost too much and is impractical. Five 5-kw heaters were put in the machine tank; three 2-kw heaters in jig and bucket housing; a 750-kw heater in pump line and four heating kits were wrapped around outside of incoming spray and tank lines. All heaters are thermostat controlled.

Coordinated Electric Drive has practically eliminated the variation in biscuit type baked products caused by human error at the Farm Crest Bakeries' new cookie plant, Columbus, Ohio. This coordinated drive is used as part of their continuous process baking operations. It enables the baker to manipulate a very large production machine easily. He can experiment and develop new and more readily marketable baked products and still retain a higher production than with singly controlled units. Standard components are used in the drive. Since the major equipment necessary for speed adjustment is remote from the machine, cleanliness is an easily attained advantage.

Capacitors reduce power costs $244 in the first month after installation at the White Motor Company's Coach Div, Cleveland, Ohio. Power factor jumped from 84.6 to 97.6%. The capacitors will pay for themselves in one year, according to K. C. Pangborn, maintenance superintendent. Suggested by Industrial Sales Dept., Cleveland Electric Illuminating Co.

Electric Fan-Type Heaters cut drying time for brew vats at the Erie Brewing Company, Erie, Pa. Seventy 420 barrel capacity wooden fermenting tanks have to be cleaned and varnished twice a year. A 4-kw fan heater placed in the bottom of a tank dries it in about 12 hr, as compared to six to seven days formerly required.



CHANCE

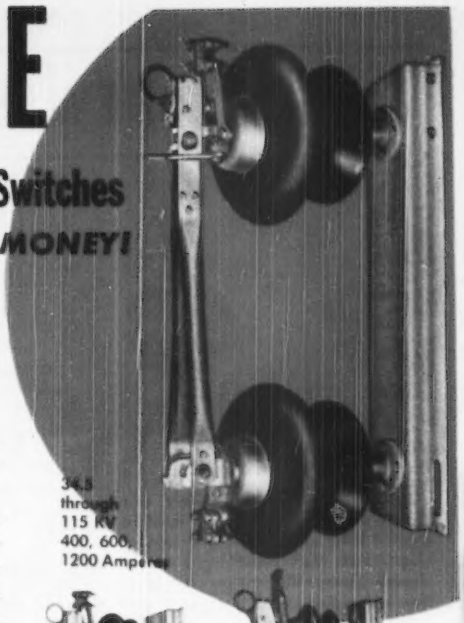
Hook Stick Disconnect Switches

... MORE FOR YOUR MONEY!

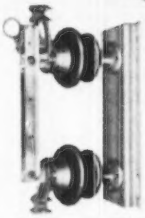
Chance Type BT Hook Stick Operated Disconnect Switches are made in a complete range of capacities for all types of single pole disconnect switch installations. They are available in single, tandem, or double throw types for horizontal mountings—upright, underhung, or vertical mountings up to 115 KV.

Dependable operation is inherent in their sturdy construction . . . RIGID CONTACT BLADES withstand heavy side thrusts, even if the closing force must be applied from an angle. Switches from 34.5 through 115 KV have a double tubular trussed blade which gives unequalled strength plus blade guides at the tongue which aid in contact alignment. 400 and 600 ampere switches rated 23 KV and below have reinforcing flanges on blades which increase rigidity and act as blade guides for closing the switch from an "out of line" position. 1200 ampere switches rated 23 KV and below have flat rigid parallel bus bar blades.

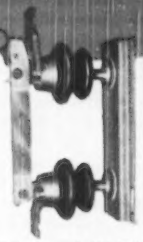
All Chance BT Switches have flanged bases that will not cut into wood supporting structures. Each size has been tested in accordance with A. I. E. E.-NEMA standards. Heat runs, high current tests, icing tests, insulation characteristics and life tests have proven the reliability of Chance Type BT Switches under all normal conditions.



34.5 through 115 KV 400, 600, 1200 Amperes

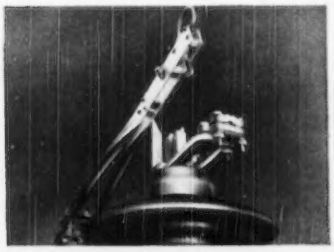


7.5 through 23 KV 400, 600 Amperes



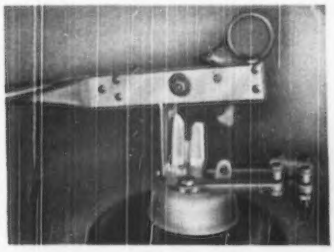
7.5 through 23 KV 1200 Amperes

Powerful Pryout for **EASY OPERATION**



A powerful lever action has been built into the pull ring mechanism and enables the operator to break ice or overcome clip adhesions with ease. All 400 and 600 ampere switches are equipped with time-saving built-in universal terminals. 1200 ampere switches have NEMA standard 4 hole terminal pads. Terminal lugs will be furnished on request.

Pressure Centered **LONG LIFE** Contacts



Pressure at the clip end is created by a conical compression spring combined with spherical washers. Split Tongue Contact casting "centers" spring pressure directly over contact area. All contacts are heavily silver plated on 1200 ampere switches. Lower ampere switches can be furnished with silver to silver or copper to copper contacts.

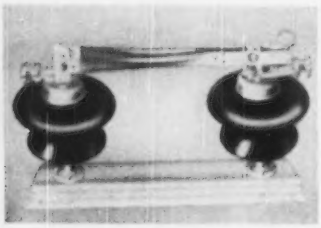
ABC INDUSTRIES

You know it's RIGHT when you specify CHANCE

A. B. CHANCE CO.

CENTRALIA, MISSOURI • SAN FRANCISCO, CALIFORNIA

NEW EQUIPMENT



Hook Stick Switch

DESIGNED to withstand heavy side thrusts when the closing force must be applied from an angle, a new tubular bladed hook stick switch has a double trussed blade. The copper tubing is flattened and sealed on the ends to give a smooth surface contact.

Another feature is the split contact tongue which permits blade pressure to be applied by a heavy coil spring directly over the center of the contact area. The switch has a double hooked spring latch that locks the blade against the impact of short circuits. Lever action built into the pull ring mechanism is said to permit easy opening of the switch against ice or clip adhesions.

This Type BT switch is available in single throw or tandem transfer designs for voltages from 34.5 through 115 kv, and 400, 600, and 1,200 amp.

A. B. Chance Co, Centralia, Mo.

•

Backfill Blade Attachment

A SIMPLE blade-to-arm linkage of a new backfill blade attachment keeps the blade vertical to the ground at all times. Used interchangeably with the company's trench hoe, the backfiller is said to speed covering and leveling of trenchwork, including electrical conduit and cable runs, etc. The unit can also be used to dig and backfill manholes.

The backfiller consists of a cable-operated steel blade mounted on a wishbone dip stick, with two tubular control arms. These arms hold the blade vertical to the ground as it is pulled toward the machine. Equipped with heavy-duty 24x60-in. blade with ½-in. reversible cutting edge, the attachment is reported to have a maximum reach of 23½ ft in any direction. It can work within 6½ ft of the center of machine rotation. It can be controlled vertically to within 1 in. of the ground surface.

Schield Bantam Co, Waverly, Ia.

•

Induction Pinion Heater

HEAT is generated within the pinion by an induction heater so that the pinion can be removed with light pressure—from either a pinion puller or wedges. Manufacturer reports that removal can be accomplished within one to two minutes, without overheating pinion surface. The same heater can be used when replacing a pinion on the shaft.

The heater is placed around the pinion when in use, ground clip is attached to a bolthead on the motor, and the power cable (carrying a ground wire) is energized with 300 amp, 440 v, 60 c. Insulation is of Class H materials.

National Electric Coil Co, 794 Chambers Rd, Columbus 16, Ohio

•

Gear Shift Drive

BOTH PRIMARY and secondary gear reductions have been incorporated in Type R3AC gearshift drives. The unit is a combination of a 5-hp, 1,200-rpm integrally mounted motor and a four-speed sliding gear transmissions. Speeds may be had from 123 to 1,140 rpm. Drives ½ through 25 hp are also made.

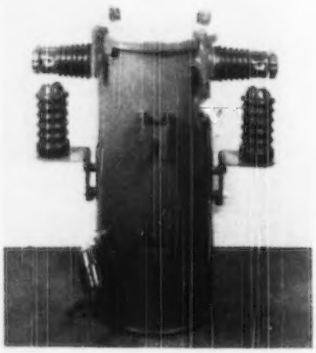
The Lima Electric Motor Co, Dept AA54, Lima, Ohio

Motor Driven Trolley

DESIGNED for attachment to standard lug-mounted electric hoists, the Moto-Trolley may be adjusted to accommodate a wide variety of beam sizes. It is powered by a crane-duty high-torque totally enclosed motor of 30 min, 55-deg rating. The magnetic contact panel is equipped with a transformer to reduce the voltage in the single-speed push-button control circuit. The single-speed trolley and the hoist motions are controlled from a four-button station.

Industrial Equipment Co, 315 N. Ada St, Chicago 7, Ill.

•



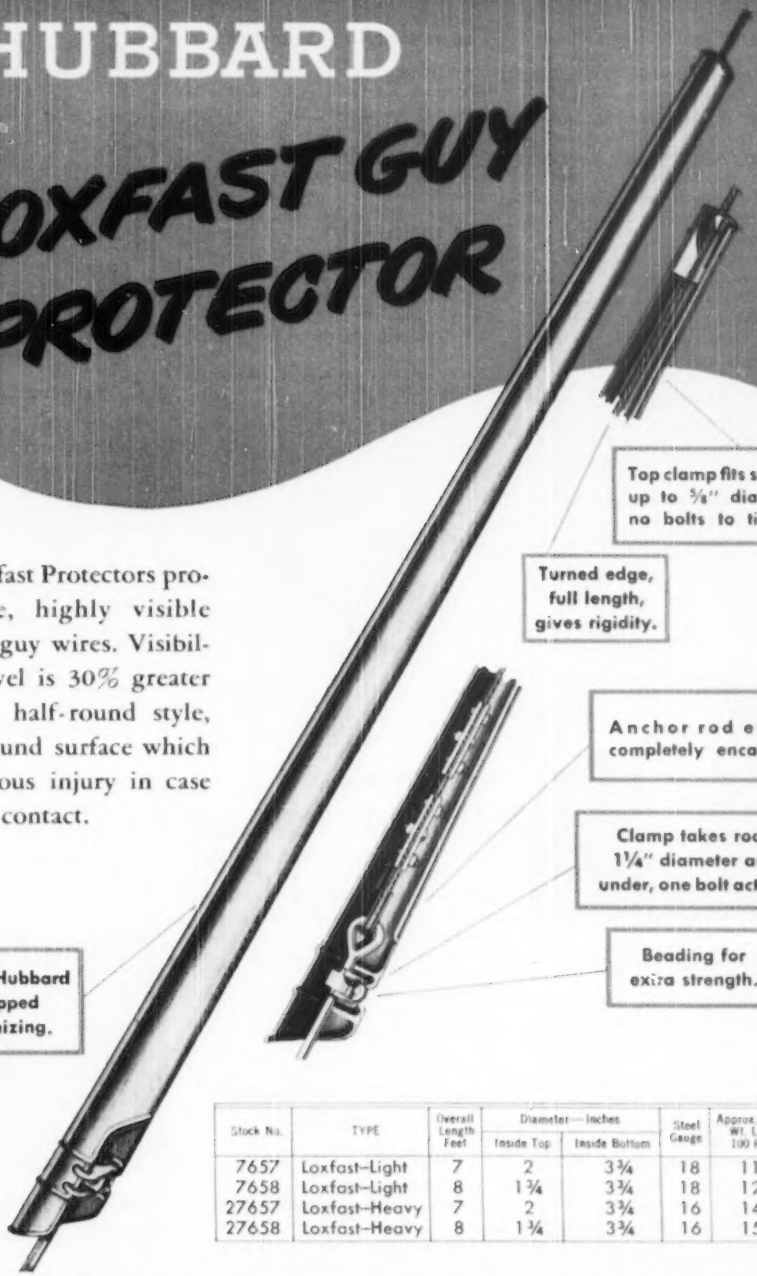
Distribution Transformers

IMPROVED CSP distribution transformers in ratings below 5,000 v are cylindrical with no overhanging hood

HUBBARD

LOXFAST GUY PROTECTOR

Hubbard Loxfast Protectors provide a large, highly visible covering for guy wires. Visibility at eye level is 30% greater than for the half-round style, plus a full-round surface which prevents serious injury in case of accidental contact.


Top clamp fits strands up to ⅝" diameter, no bolts to tighten.
Turned edge, full length, gives rigidity.
Anchor rod eyes completely encased.
Clamp takes rods 1¼" diameter and under, one bolt action.
Beading for extra strength.
Permanent—Hubbard Double-Dipped Hot Galvanizing.

Stock No.	TYPE	Overall Length Feet	Diameter—Inches		Steel Gauge	Approx. Ship Wt. Lbs., 100 Pcs.
			Inside Top	Inside Bottom		
7657	Loxfast–Light	7	2	3¾	18	1100
7658	Loxfast–Light	8	1¾	3¾	18	1200
27657	Loxfast–Heavy	7	2	3¾	16	1400
27658	Loxfast–Heavy	8	1¾	3¾	16	1550

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA

"Hang the Load on Hubbard Hardware!"

and company reports that pole space needed is decreased to make more climbing space available. The breaker operating handle is mounted between one of the primary bushings and the pole bracket so that the operating handle is accessible without reaching around a primary bushing or arrester. Both tank and cover are round to make for effective gasketing and sealing of the transformer.

Improved lightning arresters are mounted outside the tank. A series air gap isolates the arrester from the line both electrically and mechanically, and is said to almost eliminate radio interference problems.

Porcelain of the high-voltage tank-mounted bushings is said to be nearly four times as strong as that of previous pocket-mounted bushings. High-voltage line leads can be connected to the terminals without using tools. A hand-operated insulating knob tightens a mechanical connector which will accommodate conductors from No. 8 solid to No. 2 stranded.

Westinghouse Electric Corp, P. O. Box 2099, Pittsburgh, 30, Pa.

•

M-G Cleaning Outfit

SIMULTANEOUS blowing and vacuuming within the air tight Blo-Vac Cover is claimed to clean Otis type motor-generators, No. 1 to 5, eliminating scattering of carbon and copper dust throughout the elevator machine room.

The cover is heavy cotton drill, coated inside and out with Neoprene and fitted with 15 two-way zippers. When the cover is draped over the motor-generator, zippers are opened only where blower is inserted or where suction bell intake on end of the vacuum hose fits into the cover. Blowing and vacuuming then proceed and dust is collected in the vacuum tank. Vacuum power unit of the machine room and elevator shaft cleaning kit pulls an air stream of 210 cu ft per minute from the open zipper where the blower is inserted.

Lehara Sales Corp, 485 Fifth Ave, New York 17, N. Y.

Thermosetting Laminate

A NEW thermosetting laminate, called CEE grade Lamicoid, is reported to be especially suited for use in oil-filled transformers, terminal boards, and switchplates for regulators. It is a Class A insulation designed to withstand a "hottest spot" temperature of 105 C.

Power factor at 60 c is stated to be 0.017 for 0.10 kv crest, and 0.019 for 10.00 kv crest after conditioning for 24 hr at 100 C. Other properties given include: No blistering or delaminating in hot oil; good mechanical support for conducting elements due to heavy fabric base.

Mica Insulator Co, 797 Broadway, Schenectady 1, N. Y.

•

Fixture Hanger

VERSATILITY of a 4-pole (3-way, 4-wire) unit is reportedly provided in the Model AL-4660 disconnecting and lowering lighting fixtures hanger. The hanger can be used for suspending separately controlled floodlights. The lamps may be of different sizes or types, clusters of prefocused spotlights, etc. The unit can be used in any combination of circuits within its rated capacity.

The Thompson Electric Co, 1101 Power Ave, Cleveland 14, Ohio

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

LIVE LINE AMMETER
Mounts on standard hot stick; can be read at hot-stick lengths

TORQUE SCREW POLE TESTER
Gives indication of condition of pole just below ground line

OVERLOAD INDICATOR
Buzzer type alarm indicates overload on distribution transformers

CONSTANT CURRENT REGULATOR
Designed to eliminate inrush surges on series lighting circuits

AC Welders

WELDING HEAT adjustment is accomplished electrically through an ac-dc reactor in a new line of ac welders. The transformer has conventional primary and secondary windings, plus an additional winding which supplies current through a rectifier to provide dc for ac-dc reactor adjustment. None of the coils moves, and all parts are anchored in place.

A standard rectifier (20-v type) supplies power to the reactor dc winding. There are no electrical or mechanical connections between the power lines and welding cables. Approximately 100 fine adjustment settings in each of five main steps can be made.

Operation is from a 1-ph, 60-c source, either 220/440 dual voltage, 440/550 v, or 220/440/550 v. Sizes available are 200, 300, 400, and 500 amp with stationary or portable mountings.

Hobart Brothers Co, Hobart Sq, Troy, Ohio

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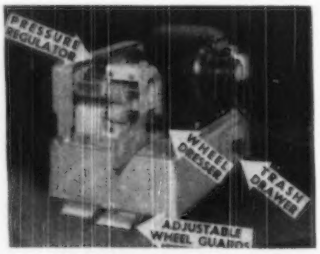
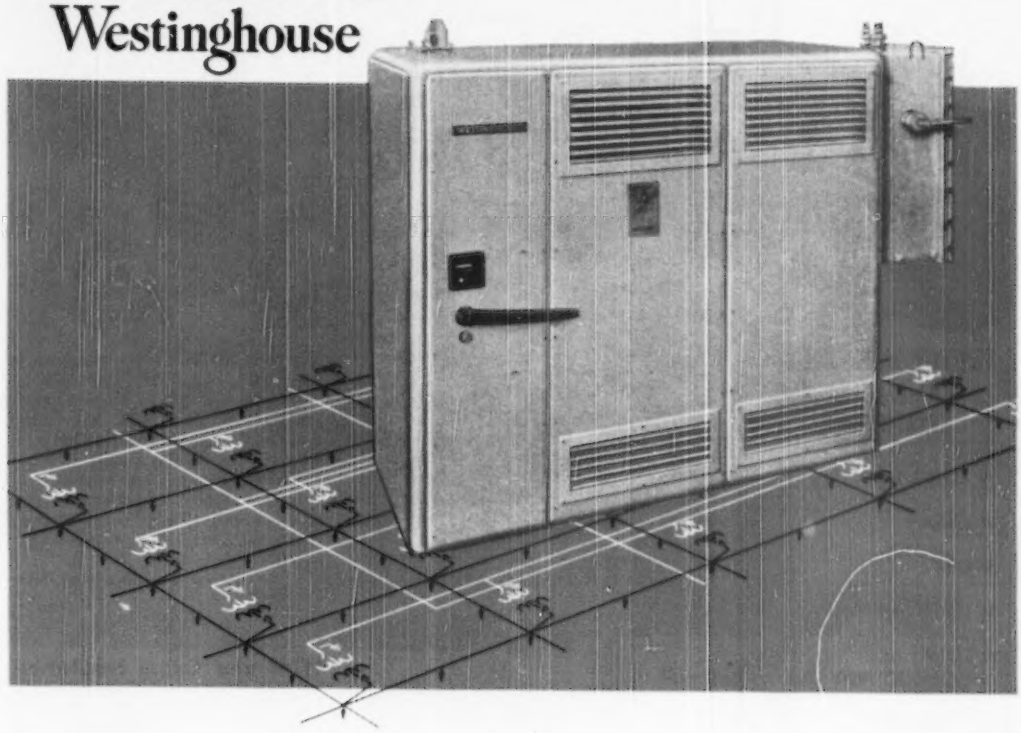


Wire Stripping Machine

FRICTIONALLY GENERATED heat is utilized by a new wire stripper to melt enamel and Formex type insulations—stripping wheels then brush it off the wires. This "frictional heat" is said to be the result of: (1) Revolving the stripping wheels at high speed, (2) controlling pressure of the stripping wheels on the wire being stripped, and (3) using stripping wheels of proper density

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



IDEAL . . . for Indoor Network Service

Safe and clean, the Westinghouse Ventilated Dry-Type "ASL" Transformer approaches perfection for indoor network service. Air-cooled, it has no liquids to filter or maintain. It is the most economical indoor transformer to install, because it meets Underwriters' code requirements without a vault.

No matter what type of network system you plan, or what your installation problems may be, Westinghouse can help you keep costs down . . . now . . . and in the future.

HERE'S WHY:

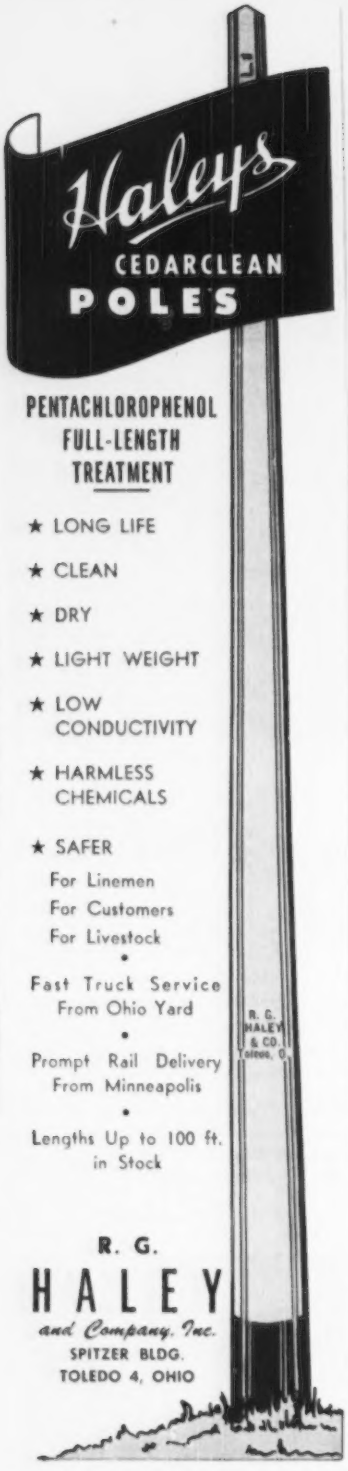
Now—There is a Westinghouse Network Transformer specifically designed to answer each of your network problems. In addition to "ASL" VENTILATED DRY-TYPES, there are SEALED DRY-TYPES, the safest transformers ever built; LIQUID-FILLED (oil or Inerteen®), most economical for general use; and TYPE "S", pole-mounted to bring network advantages to less dense areas. Standardized construction provides lower initial cost and lower installed cost, too. Special hook-up problems are eliminated.

And in the Future—Years of leadership in the design and construction of network transformers show in the high quality and maintenance-free operation of Westinghouse Transformers. In addition, our complete facilities . . . engineers and calculating boards . . . are available to help you with your network planning, to make future expansion more economical.

Ask your Westinghouse representative for further information, or write for Booklets B-4028 and B-4002-A. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70560

Westinghouse

NETWORK TRANSFORMERS



PENTACHLOROPHENOL
FULL-LENGTH
TREATMENT

★ LONG LIFE

★ CLEAN

★ DRY

★ LIGHT WEIGHT

★ LOW CONDUCTIVITY

★ HARMLESS CHEMICALS

★ SAFER
For Linemen
For Customers
For Livestock

•

Fast Truck Service
From Ohio Yard

•

Prompt Rail Delivery
From Minneapolis

•

Lengths Up to 100 ft.
in Stock

R. G.
HALEY
and Company, Inc.
SPITZER BLDG.
TOLEDO 4, OHIO

and surface characteristics. With the proper wheels, coverings or servings may also be removed.

The model shown will strip wires, gages 48 through 25, including Litz Wire up to 50/44. Wheel dressers on the machine are designed to permit use of the stripping wheels from their new diameter of 1½ in. down to about ⅞ in.

Rush Wire Stripper Div, The Eraser Co, Inc, 104 S. State St, Syracuse 2, N. Y.

•

Overcurrent Relay

MOST INVERSE time characteristic available with the company's line of relays is that of Type CO-10 overcurrent relay. It is said to coordinate with fuse curves over a wider range of currents than previous overcurrents relays. It is recommended where a long-time delay is required for light overloads, such as encountered when a feeder is re-energized after an extended outage.

Burden is about 0.3 va at tap values of current. It is constructed with a single tap block, and a non-geared induction disk. Typical time curves for 60 c appear in a supplement to Bulletin 41-280.

Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

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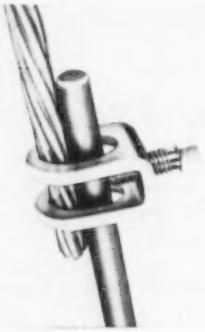


GROUND CLAMP—V-shaped slot of a new ground clamp centers the wire against the ground rod to obtain maximum contact area. Clamp is made of bronze, has an Everdur set screw, and fits rods and conductors of varying sizes.

A. B. Chance Co, Centralia, Mo.

•

Electronic Timer

AMONG APPLICATIONS of an electronic timer available in three time ranges (0.06-1.2 sec, 0.6-12 sec, and 6-120 sec) are: (1) Operation timing to control duration of such processes as electroplating, heat treating, paint spraying; (2) limit timing to stop conveyor belts if material piles up; and

(3) sequence timing with two or more timers in combinations to control durations of rod-coiling machines, centrifuges, illuminated signs, etc. Relay armature is the only moving part. Life tests are said to indicate that the new timer can perform a million or more operations under these requirements: inrush, 15 amp; carry, 10 amp; and break, 5 amp. More information is in Catalog GEA-5255.

General Electric Co, Apparatus Dept, Schenectady 5, N. Y.

•

Wire and Cable Insulation

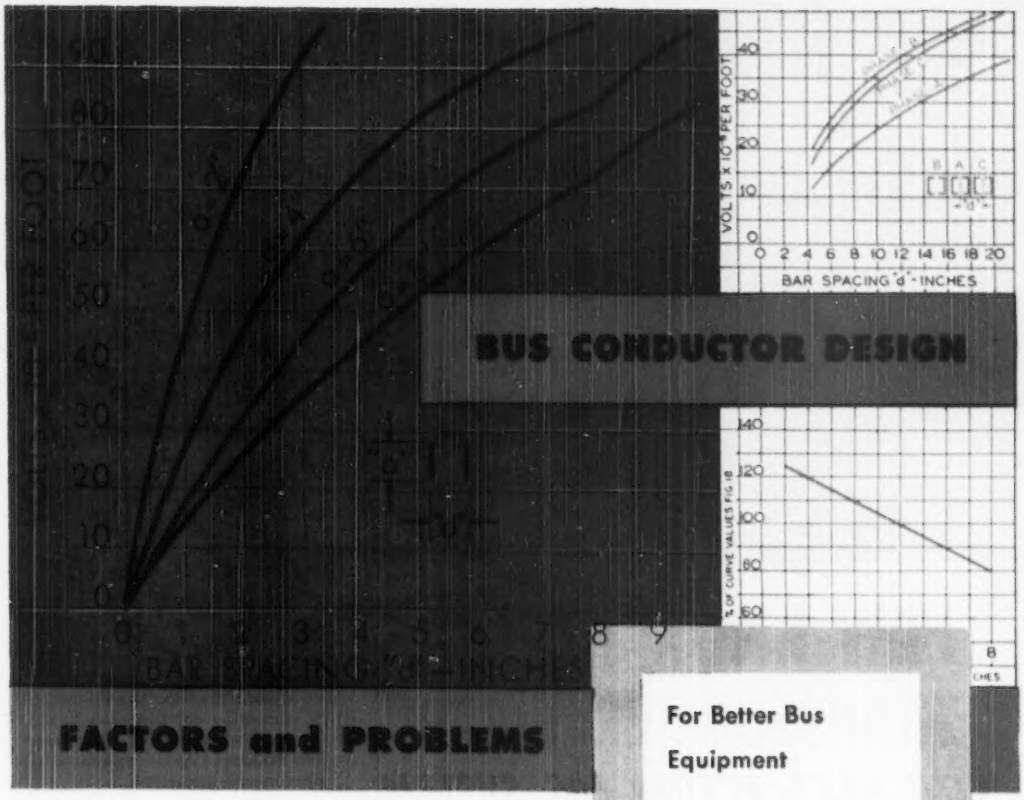
FLAME-RETARDANT plastic, called Rulan, can be used as an insulation for high-voltage street lighting cables, signal control, line wires, and multi-conductor control. Molded electrical parts and extruded electrical tape are other uses being developed.

Rulan has a power factor of 0.002 over a wide range of frequencies. Its dielectric constant is 2.7. The insulation is reported to be non-tracking and retain its electrical properties after immersion in water for long periods at elevated temperatures. Manufacturer says that low-temperature properties may be classified as excellent.

E. I. du Pont de Nemours and Co, Inc, Wilmington 98, Del.

MORE NEW PRODUCTS
about which you should know

WHEELCO INSTRUMENTS CO, CHICAGO 7, ILL., has developed a new **thermocouple** intended to withstand melting temperatures up to 3,200 F and casting temperatures normally encountered in making steel castings. . . . SEPCO CORP, POTTSTOWN, PA., has introduced an electrically operated ultra-violet **water sterilizer** for farms, rural homes or



No. 5. Voltage Drop in Laminated Busses

Voltage drop in A.C. bus conductors depends on a variety of factors, in addition to the size and shape of the conductors. By "interlacing" conductors of opposite polarity and minimizing space between phases, a laminated bus may be made to carry very heavy alternating currents at low voltage without excessive voltage drop.

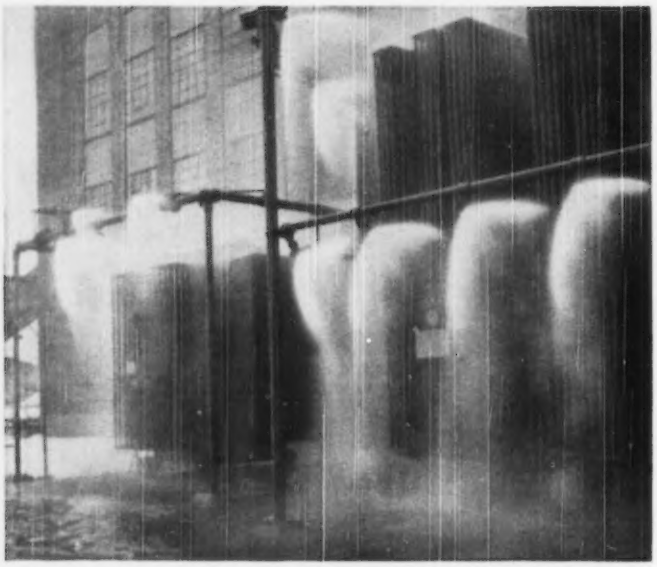
The current-carrying capacity of an A.C. multi-bar bus depends on the cross-sectional shape and area of the copper bars, their total surface area, and their location relative to each other and to the return busses.

Our Technical Department will help you plan and obtain bus equipment for any requirement. Ask for the booklet, "ANACONDA Copper Bus Conductors." The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

For Better Bus Equipment

Much original research has been done by Anaconda leading to improved bus design and construction. Today ANACONDA *products and technicians are cooperating effectively throughout the entire field of power generation, distribution and application to provide bus conductors that will afford maximum capacity, security and economy for any specified job.*

Carry the load with ANACONDA® Bus Conductors



BLAW-KNOX KNOCKS TRANSFORMER FIRES

WITH FAST-ACTION FOG SYSTEM

Deluge Systems, Wet Pipe Systems, Dry Pipe Systems, Water Spray and Fog Systems, Rate-of-Rise Sprinkler Systems, and Foam and Carbon Dioxide Extinguisher Systems.

The instant fire breaks out in any transformer—indoors or out—the Blaw-Knox rate-of-rise thermostat sounds the alarm and starts a dense, quenching fog of water to the danger spot. Instant application of fog extinguishes the fire and protects adjacent transformers and equipment. The remainder of the bank is back in service in short order. Blaw-Knox Fog Nozzles have no screens to clog, do not require treated water and maintain their effective spray pattern even at reduced pressures.

At your request a Blaw-Knox Engineer will come to your office for consultation. He will make a survey of your fire hazards, prepare a preliminary layout of a system that will give you the utmost in fire protection, and submit an estimate of costs—all without obligation.

Blaw-Knox Fire Protection Systems carry the approval of all insurance underwriters.

BLAW-KNOX SPRINKLER DIVISION
OF BLAW-KNOX CONSTRUCTION COMPANY
829 Beaver Ave., N.S., Pittsburgh 12, Pa.
Offices in Principal Cities

BLAW-KNOX FIRE PROTECTION SYSTEMS

hotels, diners, or where well water must be used; said to purify at 400 gal per hr.

PLYMOUTH RUBBER CO, INC, CANTON, MASS., is making a **plastic tape** claimed to have improved dielectric and mechanical properties. . . . AMERICAN INSTRUMENT CO, INC, SILVER SPRING, MD., has introduced an electronic **relay** for power control from delicate contact-making instruments; also for actuating motors, valves, and liquid level control. Information is in Bulletin 2178.

GENERAL ELECTRIC CO, CONSTRUCTION MATERIALS DEPT, BRIDGEPORT 2, CONN., offers the Levelock, a switch box with improved **locking mechanism** that wedges the side plates tightly in position. . . . NATIONAL ELECTRIC PRODUCTS CORP, CHAMBER OF COMMERCE BLDG, PITTSBURGH 19, PA., is marketing a series of three shallow pan-type **junction boxes** for its one, two or three-duct underfloor wiring systems.

UNITED STATES RUBBER CO, ROCKEFELLER CENTER, NEW YORK 20, N. Y., has developed a new plastic that can be used for electrical **insulators.** It is thermosetting, has good resistance to fire, and dielectric strength of 500 v per mil, according to the manufacturer. . . . MISSION ELECTRIC MFG CO, INC, 132 W. COLORADO ST, PASADENA 1, CAL., has designed a 1/30-hp 400-c **motor,** 70% efficiency; up to ½ hp can be supplied in same frame size.

TYNISWITCH ELECTRONIC SALES CO, 8 WEST ST, MERIDEN, CONN., is making a **miniature switch** that has pure silver contacts and a spring structure said to provide "bounceless" closure and maximum load rating for a given operating pressure. It is rated 15 amp, 125 v, or 7.5 amp, 250 v ac; has spst action.

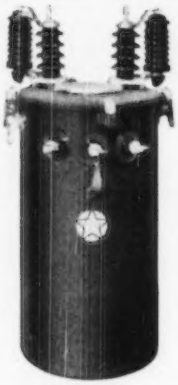
RADIO CORP OF AMERICA, CAMDEN, N. J., is offering new Model CMV-4A Carfone two-way **mobile radio** for use by public utilities particularly in crowded metropolitan areas or for broader coverage in suburban areas; supplies 30 w over its 152-174 mc range. . . . PANTEX MFG CORP, BOX 660, PAWTUCKET, R. I., has announced a cartridge-type hydraulic pressure **switch** operating with as little as 12-18% pressure differential; withstands temperature range from minus 65 F to 160 F.

VICKERS ELECTRIC DIV, 1815 LOCUST ST, ST. LOUIS 3, MO., is offering three types of **magnetic amplifiers,** including 60-c amplifiers with power levels ranging from 65 to 3,660 w. Applications include line-to-line voltage regulators, speed and frequency regulators, instrument amplifiers and control relays.

2 More POLE STARS

In addition to its regular line of Pole Star Distribution Transformers, Pennsylvania offers two new types of Pole Stars designed to meet a wider range of requirements:

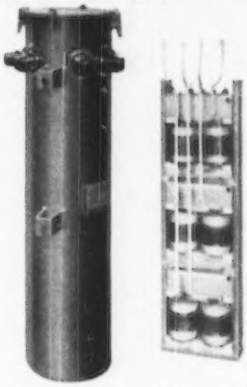
PROTECTED POLE STAR



- ★ Lightning Arresters
- ★ Protective Link
- ★ Low Voltage Breaker
- ★ Signal Light and Breaker Operating Handle
- ★ Emergency Breaker Control
- ★ Ground Discharge Gap or Ground Connector

RATINGS: 3 KVA THROUGH 100 KVA

TRIPLEX POLE STAR



- ★ Three Single Phase Transformers In One Tank
- ★ Quicker, easier and less costly to install
- ★ Less weight on the pole
- ★ Less wind resistance
- ★ Less space required for hauling and storage

RATINGS: 9 KVA THROUGH 112½ KVA

plus

the following outstanding features of the Pole Star:

- ★ Inherent Low Exciting Current
- ★ Core and Coil unit easily disassembled and rebuilt
- ★ Sealed tank construction with synthetic rubber gaskets
- ★ Light weights and small dimensions
- ★ Low noise level

RATINGS: 3 KVA THROUGH 100 KVA

For further information contact your nearest Pennsylvania representative or write to Pennsylvania Transformer Company, Box 330, Canonsburg, Pennsylvania

Pennsylvania TRANSFORMERS

POLE STAR

Pennsylvania
TRANSFORMER COMPANY
CANONSBURG, PENNSYLVANIA
GREATER PITTSBURGH DISTRICT

P.S.
Let the **POLE STAR** be your guide . . .

Product Of Long Experience
Safe Thrifty And Reliable

Working Day and Night to Serve You

Here at Ryerson we're making an all-out effort to ease your steel-buying problems as much as possible.

No, we can't deliver all the steels you may need. Critical shortages growing out of the international situation prevent that. But what we can do—what we *are* doing is working shoulder-to-shoulder to see that you get every *available* item required as quickly as we can get it to you.

In spite of unbalanced stocks, we still have fairly good overall tonnage on hand. And the services of our experienced specialists may prove highly valuable in determining alternates, when the steels you need aren't readily available.

So for any kind of steel—any time—contact your nearby Ryerson plant. You can be sure we'll do our level best to take care of you.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled and cold finished
STRUCTURALS—Channels, angles, beams, etc.
PLATES—Many types including Inland 4-Way Safety Plate
SHEETS—Hot and cold rolled, many types and coatings
TUBING—Seamless and welded, mechanical and boiler tubes
ALLOYS—Hot rolled, cold finished, heat treated
STAINLESS—Allegheny bars, plates, sheets, tubes, etc.
REINFORCING—Bars and accessories, spirals, wire mesh
BABBITT—Glyco bearing metal, also Ryertex plastic bearings
MACHINERY & TOOLS—For metal fabrication

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • PHILADELPHIA • CINCINNATI • CLEVELAND
DETROIT • PITTSBURGH • BUFFALO • CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO

NEWS ABOUT PEOPLE

Fite Made Florida P&L Manager
Fullerton, Kinsman Also Promoted

R. H. FITE

R. C. FULLERTON

Three major executive changes have been made by Florida Power & Light Co.

R. H. Fite, vice president in charge of commercial activities, was elected vice president and general manager. He will have overall supervision of company operations.

R. C. Fullerton was named a vice president. George C. Kinsman, director of economic research for the company before World War II, will rejoin the utility as a vice president.

Fite started in 1923 with General Electric Co. where he worked in Schenectady, N. Y., and Nashville. He joined Florida P&L in 1926 as an engineer. Transferred to the rate department, he later became head of that department. In 1923 he was appointed general sales manager.

Fite left Florida P&L in 1936 to enter the sales department of Ebasco Services, Inc, in New York and three years later became head of Ebasco's sales department. In 1941 he was appointed head of the Washington office of Ebasco. He returned to the Florida utility in 1945 as a vice president and director.

Fullerton started in Florida P&L's Coral Gables office in 1930. After serving as chief clerk in the Coral Gables, Miami Beach, and Miami offices, he was named director of customer service in 1942 and assistant treasurer in 1945.

Kinsman went to Coral Gables in 1925 as assistant to the city manager. He joined Florida Power & Light in 1928, became southern division sales manager in 1935, and later was named director of economic research. Since the war he has been with Pacific Gas & Electric Co and the California Manufacturers Association.

GEORGE C. KINSMAN

•

C. C. Broschart has been elected president of Bradley Co, Inc, to fill the vacancy created by the death of Paul T. Bradley. **G. W. Schaffner** will continue to manage the Washington office of the Pennsylvania company, a manufacturers representative with offices in Philadelphia and Washington. The firm will continue to operate under the policies laid down by its late president.

K. K. Kost Is Appointed Associate Editor of EW

Kenneth K. Kost, news editor of ELECTRICAL WORLD since 1944, has been appointed associate editor in charge of the news department. He succeeds William B. Whichard, Jr, who has returned to the Washington News Bureau of the McGraw-Hill Publishing Co.

Kost came to ELECTRICAL WORLD from Bethlehem Steel Co. Earlier he had taught journalism for 12 years at Lehigh University, where he also directed all student publications and for a time served as assistant director of

KENNETH K. KOST

public relations. He was executive secretary of the Intercollegiate Newspaper Association, a group of about 30 newspapers published at Eastern universities.

Kost's newspaper experience included work in all editorial fields with the Bethlehem (Pa.) *Globe-Times* and the Allentown (Pa.) *Morning Call*. For about a year he was editor in charge of coverage in two counties for the latter paper, including direction of its largest branch office at Bethlehem.

Whichard joined ELECTRICAL WORLD in 1946 as Washington correspondent. Last year he was transferred to the New York office as associate editor. Before coming to McGraw-Hill he worked for the Washington *Times-Herald*, *News Syndicate*, and *Public Utilities Fortnightly*.

•

Alan J. Bronold has been appointed sales manager of Sterling Electric Motors, Inc, Los Angeles. He succeeds

Overhead Service Cable?

You Specify it— We'll Build it!

NEUTRAL SUPPORTED CABLES

One, two, three or more phase conductors spiralled around the supporting neutral conductor.

1. **DOUBLE LAYER TYPE** — Phase wires have double-layer covering — Performance Grade Rubber Insulation protected by outer sheath of abrasion resistant Neoprene.
2. **SINGLE LAYER TYPE** — Phase wires have single layer covering of Insulating Neoprene.

TWISTED CABLES

Two, three or more conductors insulated with Performance Grade Rubber.

1. **RUBBER and BRAID TYPES** — (a) Conductors twisted together and covered with weather and flame resistant braid.
   (b) Conductors covered with moisture resistant braid. Twisted cable covered with moisture resistant braid.
   (c) Conductors covered with weather and flame resistant braid . . . then twisted together. One conductor often of double or triple weather proof wire to serve as the neutral.
2. **RUBBER and NEOPRENE TYPE** — Conductors sheathed with abrasion resistant Neoprene . . . then twisted together. One conductor often of Neoprene line wire to serve as the neutral.

CONCENTRIC NEUTRAL CABLES

One, two, three or more phase conductors insulated with Performance Grade Rubber, Sheathed with Neoprene, phase conductors assembled either parallel or twisted.

1. **NEOPRENE JACKETED TYPE** — Neutral conductor consisting of many small copper wires applied concentrically . . . then protected with a sheath of abrasion resistant Neoprene.
2. **EMBEDDED NEUTRAL TYPE** — Neutral conductor (many small copper wires applied concentrically) embedded in a covering of felted unspun cotton — weather-resistant finish.

OPEN WIRE SERVICES

Copper or aluminum conductors covered with Neoprene or Polyethylene.

NATIONAL ELECTRIC CODE STANDARDS

Type SD Service drop cables. Type SE, Style A, armored service entrance cable. Type SE, Style U, unarmored Service entrance cable.

Let us know your needs for any and all types of overhead service cables. Write for recommendations.

COLLYER INSULATED WIRE CO.
243 ROOSEVELT AVE., PAWTUCKET, R. I.

CHOOSE *Collyer*

Allen Adams, who is retiring from active sales management because of ill health but will continue as secretary-treasurer. Bronold worked for Vacuum Oil Co before 1926 and since then has been with Westinghouse Electric Corp, most recently as assistant general sales manager in charge of national sales for the Sturtevant Division.

•

GE Names Apparatus, Manufacturing Executives

Robert Paxton, manager of the Transformer and Allied Product Divisions of the General Electric Co Apparatus Department, has been appointed manager of manufacturing policy for GE. He succeeds to the responsibilities of Raymond R. Rausch, vice president, who has resigned to return to the automotive industry.

Ab Martin is the new assistant manager of the Apparatus Department's Fort Wayne (Ind.) Works. Other Apparatus Department appointments include Bascom H. Caldwell, Jr, as assistant manager of engineering and D. E. Brainard, Howard D. Snively, Robert V. Shepherd, and Robert W. Wieseman as division engineers.

Paxton joined GE in 1923 and worked in the switchboard department in Schenectady and at the Philadelphia Works, where he became manufacturing manager of the metal-enclosed division. In 1940 he was made assistant to the works manager at Philadelphia and a year later manager.

Paxton was appointed manager of the Pittsfield Apparatus Works in 1945. Two years ago he was put in charge of the Transformer and Allied Product Divisions, one of the company's largest.

Martin has been manager of the Oakland (Calif.) Works. He went to GE in 1929 and on the test course served as foreman and assistant to the manager on special assignments. He also has served as assistant to the Apparatus Department's supervisor of costs, assistant manager of the Bloomfield (N. J.) Works, supervisor of personnel and community relations in the Manufacturing Division of the department; and assistant to the manager of the department's Employee and Community Relations Division. He went to Oakland in 1948.

•

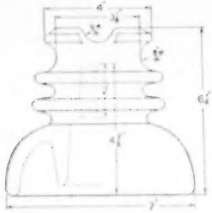
Frank A. Banks, builder of Grand Coulee and five other major dams, is retiring this month after 44 years with the Bureau of Reclamation. The Bureau's oldest employee in terms of service, Banks will continue as an advisor. Columbia River Basin Dams on which Banks has worked include Jack-

NEW FROM VICTOR

No. 26

PINTYPE INSULATOR

SOLVES 2 DISTRIBUTION PROBLEMS



NO. 26 DATA

Nominal voltage rating	27 KV.
60 cycle dry flashover	95 KV.
60 cycle wet flashover	60 KV.
Negative impulse flashover	190 KV.
Positive impulse flashover	150 KV.
Dry arcing distance	7⅝ in.
Leakage distance	15 in.
Pinhole diameter	1⅛ in.
Recommended pin height	7 in.
Cantilever strength	3,000 Lbs.
RNI (plain)	8,000 MV.
RNI (radio-freed)	100 MV.
1000 KC at applied	15 KV.

1. **STEPPED-UP VOLTAGES**—VICTOR's No. 26 is designed to be used in *raising* insulation levels on present lines, or *providing* for future voltage increases on proposed low voltage lines. It has a rated 60 cycle dry flashover of 95 KV. and a wet flashover of 60 KV., with a nominal voltage rating of 27 KV. So, by installing these new pintypes now, you can keep replacement costs at a minimum when line-loads are increased.

2. **CONTAMINATED AREAS**—VICTOR's No. 26 insulator lowers maintenance costs in fog and contaminated regions because of its *self-cleaning design* and *long leakage distance*. This means fewer replacements as well as less maintenance.

For more information consult our new Condensed Catalog (Bulletin No. 4), write us, or call your VICTOR representative!

VICTOR INSULATORS Inc.

VICTOR, NEW YORK

Look for this trade mark of enduring service

V

A typical modern industrial plant where Hevi Duty Transformers provide efficient electrical distribution.

75 KVA
3 Phase
60 Cycle
480-120/208 Y
TRANSFORMER

Install
HEVI DUTY
DRY TYPE
TRANSFORMERS
at load centers
...and eliminate long, heavy secondary runs

Installations now operating in many nationally known industrial plants are proving the ability of Hevi Duty Transformers to provide efficient economical electrical distribution.

Conservative electrical design and the simple rugged construction of Hevi Duty Transformers assure many years of trouble-free service. STANDARD or SPECIAL types are available in sizes from 1/4 to 1000 KVA with primary ratings to 15,000 volts.

Write for Bulletin HD-499

HEVI DUTY ELECTRIC COMPANY
HEAT TREATING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY
DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS
MILWAUKEE 1, WISCONSIN

son Lake on the Snake River, American Falls on the Snake, Arrowrock on the Boise River, Owyhee Dam on the Owyhee River of Oregon, and Thief Valley on the Powder River of Oregon. Banks, who has been district manager supervising construction and administration of the Columbia Basin Project since 1945, also has supervised construction of four large earth-fill irrigation dams and the world's largest pumping plant.

James J. Hagan has been appointed assistant plant manager of Weston Electrical Instrument Corp, Newark, N. J. He joined Weston in 1942 as a time study engineer and three years later was made personnel director.

OBITUARY

John C. Weadock

John C. Weadock, 90, former senior law partner of Wendell L. Willkie and later of Justin R. Whiting, now president of Consumers Power Co, died in New York City Sept 10. Weadock was general counsel of Commonwealth & Southern Corp from its organization until its dissolution last year.

Weadock was a member of the bars of Michigan and New York and the United States Supreme Court. In Michigan he was in partnership with his brother, the late Thomas A. E. Weadock, justice of the Michigan Supreme Court and member of Congress. In New York he served as senior member in the firms of J. C. and B. F. Weadock, Weadock & Willkie, and Weadock & Whiting.

Weadock helped organize Consumers Power, and the company later named for him what is now its largest power plant, the John C. Weadock Plant on Saginaw Bay near Bay City. The station was dedicated by Willkie on its completion in 1940.

•

Frederick W. Doolittle

Frederick W. Doolittle, 64, an operating and financial consultant to North American Co and a former vice president of the holding company, died Sept 13 in Mineola, L. I., N. Y.

Doolittle retired as vice president and member of the executive committee in 1936. He served as a director until 1947.

A former faculty member at the Universities of Illinois, Colorado, and Wisconsin, Doolittle helped develop the technical work of the Public Utilities Commission of Wisconsin shortly after its organization and of the first pub-

lic utility commission in Illinois. For a short time he was secretary of the Illinois commission. From 1914 to 1916 he directed the bureau of fare research of the American Electric Railway Association. He also had designed steel and concrete structures for the Chicago, Minneapolis and St. Paul Railroad.

Doolittle became connected with North American in 1916 as consulting

F. W. DOOLITTLE

engineer for its Wisconsin subsidiaries. In 1923 he was elected vice president and director. Treasurer of the Transit Code Authority under the National Recovery Act, Doolittle was the author of the book, "Cost of Urban Transportation Service," and a number of technical articles. He also was a past president of the Princeton Engineering Association and chairman of the committee on public utilities and law of the Commerce and Industry Association of New York.

•

Edward M. Markham

Maj Gen Edward M. Markham (retired), 73, former chief of the Army Corps of Engineers, died Sept 14 in Albany.

Markham spent 39 years in the Engineers and directed many long-range projects, particularly on the Great Lakes. He served as assistant engineer for the District of Columbia, as professor at West Point, and after World War I as chief engineer of the Army of Occupation in Germany. Markham was Chief of Engineers from 1933 to 1938 and later served as Commissioner of Public Works for New York City and president of Great Lakes Dredge and Docks Co, Chicago.

•

Gideon Dexter, 77, superintendent of the Roseway Plant of Nova Scotia Power Commission at Shelburne, N. S., for 34 years, died recently in Shelburne.

NEW ANTIOXIDANT FOR TRANSFORMER OIL . . .

KOPPERS

IMPRUVOL 20

EXTENSIVE laboratory tests indicate that Koppers new liquid inhibitor, Impruvol 20, will greatly extend the useful life of transformer oils. With the addition of as little as .5 to 1.5% of Impruvol 20, the oxidation stability of new oil is increased 5 to 15 times. Similar results are shown with reclaimed oils.

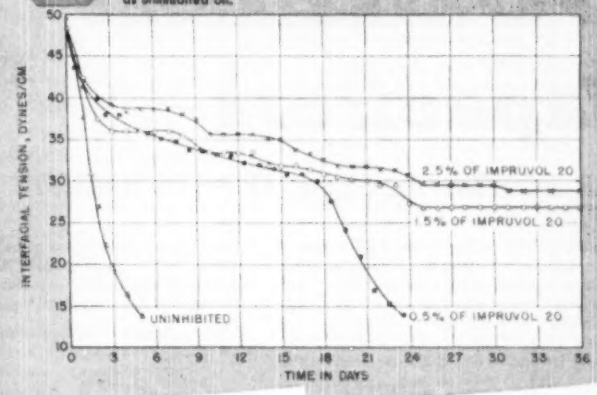
DBPC—the oxidation inhibitor that has been used in turbine oils for many years—is the active ingredient in Impruvol 20. However, the Koppers inhibitor is specially compounded, and is made into an oil solution for easy application to transformer oils. Further, Impruvol 20 will stay in the oil in the presence of water.

Study the tests shown below. They will tell you, better than words, what Impruvol 20 can do. If you are interested in improving the life of your transformer oil, write for Bulletin C-O-140, to Koppers Company, Inc., Chemical Division, Pittsburgh 19, Pa.

KOPPERS COMPANY, INC.
Chemical Division **Pittsburgh 19, Pa.**

KOPPERS

Interfacial Tension values under 95°C Oxidation Tests show Impruvol 20 inhibited oil impressively delayed in oxidation and of no stage as rapid as uninhibited oil.



TESTS ON A RECLAIMED OIL

	Time to Reach Sludge Stage	Increase in Oil Life
Uninhibited	2 days	—
0.5% of Impruvol 20 added	10 days	500%
1.5% of Impruvol 20 added	32 days	1,600%
2.5% of Impruvol 20 added	45 days	2,250%

TESTS ON A NEW OIL

	Time to Reach Sludge Stage	Increase in Oil Life
Uninhibited	5 days	—
0.5% of Impruvol 20 added	23 days	460%
1.5% of Impruvol 20 added	70 days	1,400%

Another C-D Field Performance Record:

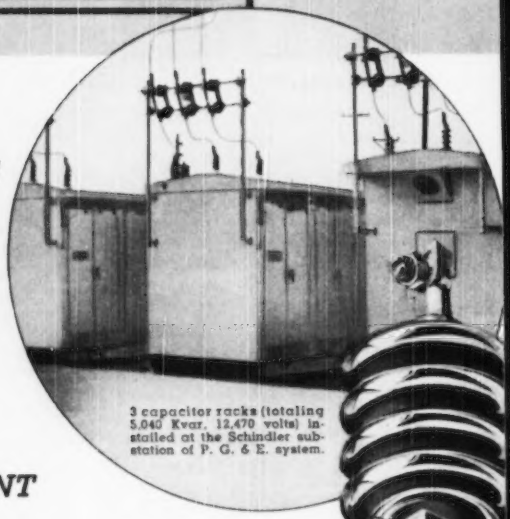
OVER 4.9 BILLION KVAR HOURS OF TROUBLE-FREE CAPACITOR SERVICE

From its C-D Capacitor Installations:

REPORTS PACIFIC GAS AND ELECTRIC

CORNELL-DUBILIER Capacitors

FOR POWER-FACTOR IMPROVEMENT



3 capacitor racks (totaling 5,040 Kvar, 12,470 volts) installed at the Schindler substation of P. G. & E. system.

Here's *solid* field performance! Pacific Gas & Electric ordered its first C-D capacitors for power-factor improvement back in 1938, and followed this up with many additional C-D installations. To date, these capacitors have delivered 4,922,981,200 Kvar/hrs. of trouble-free operation for Pacific Gas & Electric, and they're still functioning as good as new.

Cornell-Dubilier capacitor installations at Pacific Gas & Electric have had to withstand the extreme climatic conditions of below-zero temperatures in the snow-capped High Sierras, the corrosive salt air of the coastal areas, and summer heat of the great Central Valley of California.

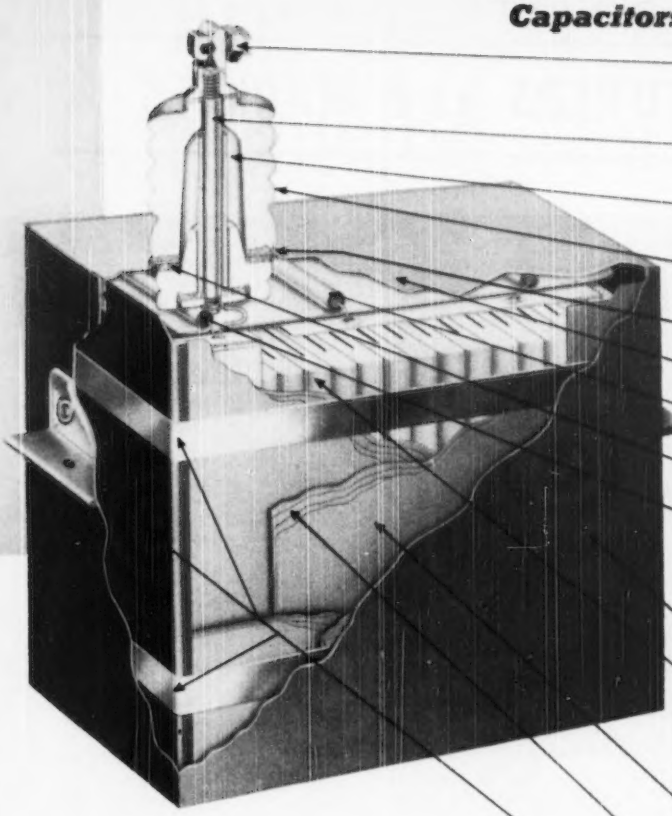
This characteristic of *dependable service under severe operating conditions* is built into every C-D capacitor, through engineering specifications that provide for maximum reliability at the lowest possible cost.

12-15 Kvar 2,400 volt pole capacitors on P. G. & E. system.

2,520 Kvar 12,470 volt rack-type capacitor installation at Pacific Gas & Electric's Kearney sub-station.

12-15 Kvar C-D pole-type capacitors on P. G. & E.'s system.

HERE'S WHY Cornell-Dubilier Capacitors rate tops in the field:



Solderless service connector — A C-D Exclusive! Easy to replace. No danger of stripping or distorting connector and thereby ruining an otherwise perfect capacitor.

Bushing assembly rigidly secured by 7/16" Brass Stud — Designed to withstand heavy service abuse.

Dykanol-filled bushing Increases Accepted Flash-Over Safety Factor. Insures high level of impulse withstand.

Heavy-duty, four petticoat, wet process, glazed porcelain bushing. Longer creepage path, less breakage hazard, high impulse rating.

Bushing designed to prevent gasket deformation. Assures permanent hermetic seal of unit.

Embossed, rigid cover Prevents Flexing and Stress on Bushing. Provides water shed.

Discharge resistors — safeguard linemen by reducing residual charge to less than 50 volts in 5 minutes.

Varnished double cork gaskets. Provide high pressure seal between bushing and case.

Terminal discharge resistor firmly connected to each series section, instead of terminal to terminal. Provides effective discharge between each series group and balanced voltage distribution.

C-D capacitors employ current-limiting fuses with high interrupting capacity.

Capacitor stack hermetically sealed in Container.

Many small sections in series-parallel connection. Extremely low voltage gradient per section; less heating; no corona; longer life; lower power-factor; lowest dielectric unit stress.

Wide margin maintained between paper and foil coordinated with major insulation to provide highest impulse level.

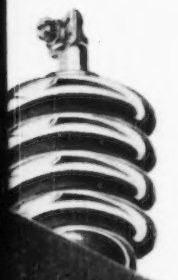
Impregnated and submerged in Special Non-inflammable, Non-explosive Dykanol. Results in lower unit weight per Kvar; high stability and longer life; less hazard to accessory equipment.

Laminated insulation between case and sections. Insures safety-factor against high transient voltages.

Sturdy steel tension equalizing band and Rigid End Plates. Insures uniform distribution of stack-pressure, still further increasing dependability of unit.

Wrap-around bracket — another C-D exclusive! Two wraps extending around sides affording greater safety against impact stress in shipping and handling. That's why C-D racks can be shipped completely assembled, ready for energizing.

All C-D capacitors (from 230 to 13,800 volts), are given an energization test as a form of quality control by applying full rated voltage for minimum period of time sufficient to establish ultimate heat rise. ***(Only C-D gives you energization tested capacitors! That's why you get more for your capacitor dollar.)***



Among the many reasons why C-D industrial, pole and station-type capacitors have given so many years of trouble-free service under the severest operating conditions is C-D's engineering standard which provides for the lowest dielectric unit stress and highest major insulation level. C-D station-type capacitors can be provided in weatherproof housings, switched or unswitched and completely assembled for energizing at field site, to meet specific sub-station needs. Your inquiries are cordially invited. Our field engineers will be glad to discuss the many dollar and maintenance saving characteristics of these installations. **Cornell-Dubilier Electric Corp., South Plainfield, New Jersey.**

Other Plants: New Bedford, Worcester and Brookline, Mass.; Providence, R. I.; Indianapolis, Ind.; and Cleveland, Ohio.

1910 1950

CORNELL-DUBILIER

CAPACITORS

BEST BY FIELD TEST!

MANUFACTURERS and MARKETS

"YOU TOOK MY SHIRT, now take my tie," General Electric Co Vice President L. R. Boulware (right) tells John H. Callahan (left), district official of the International Union of Electrical Workers, CIO, after settlement of IUE's strike at several GE plants. Mediator Robert W. Donnahoo (center) watches. Contracts signed with the CIO union and with the United Electrical Workers gave some 100,000 employees a 10¢-an-hour wage boost

All Quiet on General Electric Front; Agreements Reached with IUE, UE

General Electric Co and the two unions representing most of its employees have agreed on contracts calling for a 10¢-an-hour pay increase, a contributory pension plan with a minimum retirement income of $125 a month, and insurance benefits.

The day after terms of the contract were agreed on GE announced 6 to 13% price increases on refrigerators, home freezers, ranges, water heaters, and automatic dishwashers. Similar price boosts for other products will be made soon, the company said. GE said the increases, its first general price adjustment since the Korean war began, were necessary to offset the cost of the wage increases and other benefits as well as higher materials prices.

The agreement reached with the International Union of Electrical Workers, CIO, covers an estimated 60,000 workers in 60 plants. About 40,000 of them, principally at Lynn and Everett, Mass., and Syracuse, N. Y., had been on strike. The United Electrical, Radio & Machine Workers of America, independent union recently expelled from the CIO, represents about 46,000 workers.

Terms of the contracts were similar for the most part. Half the 10¢ general wage increase has been in effect since July 1. The additional 5¢ boost was made effective Sept 15. A further wage increase of 5 to 5½¢ an hour for certain skilled trades has been in effect in many locations since June, the company said.

The minimum pension of $125 a month includes social security. Payments begin at normal retirement age after 25 years' service. This part of the agreements is retroactive to July 1.

Insurance benefits include life, retirement, accidental death and dismemberment, weekly sickness and accident coverage. Workers will assume full cost of hospitalization, surgical, and maternity benefits, also provided for in the plan.

The IUE contract, which was expected to be ratified by the union's conference board last week, is for one year. UE's two-year agreement must be approved by a conference board and the locals.

Principal difference between the two agreements is the one-way escalator clause in the IUE contract. This permits reopening on March 15, with increases of 1¢ an hour for every 1.14 advance in the government's cost-of-living index between Sept 15 and that date. There is no provision for a downward revision of wages if the index should drop.

UE rejected the escalator clause and instead got three wage reopenings, one every six months during the two-year period. None of these reopenings is to be tied to the cost of living index.

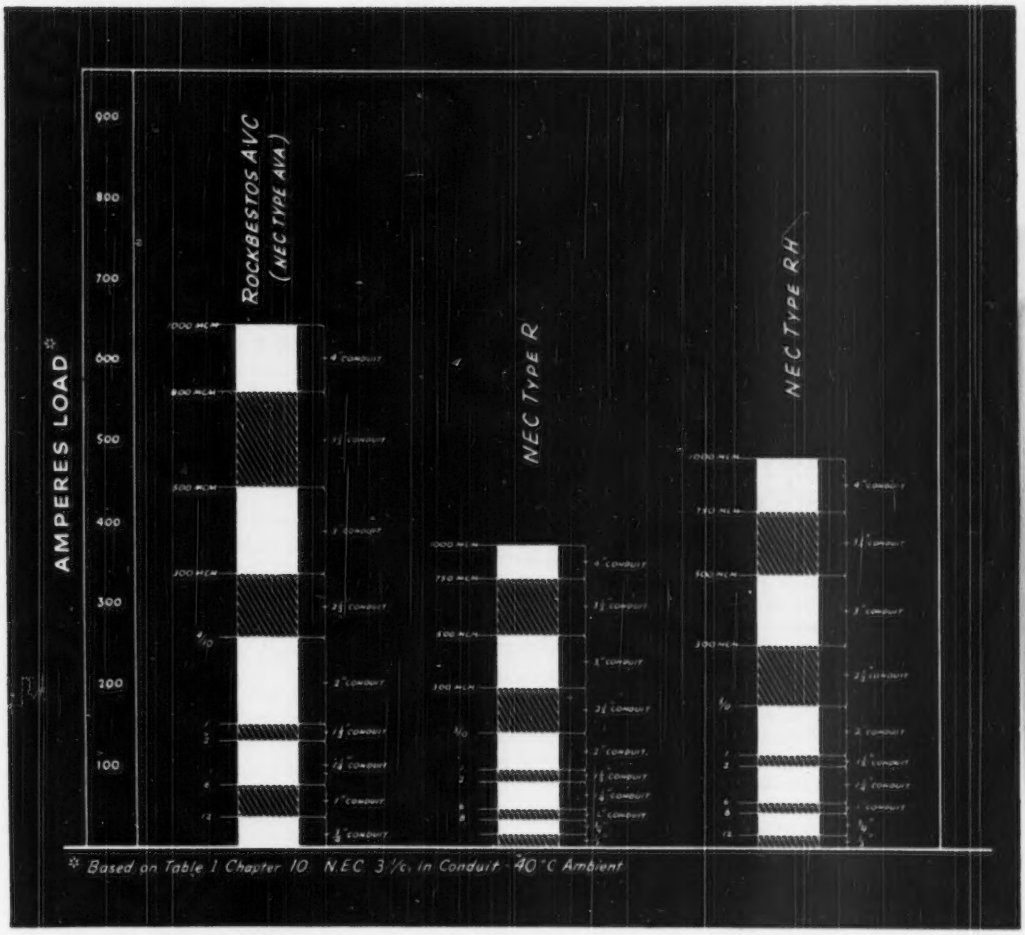
Meanwhile UE announced it would proceed with strike votes among its 22,000 members employed by Westinghouse Electric Corp. The union said an 8¢-an-hour wage increase offered by Westinghouse was unsatisfactory because the proposal included "inferior" pension and insurance plans.

MANUFACTURING BRIEFS

Controls on exports of electrical power capacitors and electrical insulating materials have been tightened by the Commerce Department. Licenses now are required for shipment to any destination except Canada. Formerly they were needed only for goods going outside the Western Hemisphere. Objects are to protect the domestic economy against scarcities and prevent strategic goods from moving to the Soviet bloc.

Electronics engineers specializing in the communications field are urgently needed in the research and development laboratories of the Army Signal Corps at Fort Monmouth, N. J., according to the post commander. Salaries range from $3,825 to $5,400 a year. Fort Monmouth also wants experienced technical writers and train-

Are Electrical Loads Outgrowing Your Conduit?



Here's the fast, inexpensive way to take care of electrical loads that have outgrown their conduits — just replace present cable with Rockbestos A.V.C. . . . *with Rockbestos A.V.C. you can increase conduit capacity without increasing conduit size.*

Use A.V.C. whenever load growth outruns present wiring. With it you can easily increase capacity without buying and installing larger conduit or fittings. Write today for the booklet "Rx for a Building with Hardening of the Electrical Arteries."

ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONN.
NEW YORK CLEVELAND DETROIT CHICAGO
PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CAL.

ROCKBESTOS A.V.C.
has a HIGHER AMPERE RATING

Copperweld* Chain Link Fence is the protective fence that protects itself. It *never* needs a drop of paint—no maintenance costs to worry about. There's no other fence like it. It is made of Copperweld Wire—with a thick, durable copper covering inseparably "Molten-Welded" to a strong steel core.

Because of its unique construction, Copperweld Fence is rust-proof, corrosion-proof. It provides long lasting property protection regardless of atmospheric conditions. It stays strong and in alignment. It costs less because it lasts longer.

Write today for a sample of Copperweld Fence and a copy of our new catalog—free on request.

*Trade Mark

COPPERWELD STEEL COMPANY
1025 Monongahela Ave., Glassport, Pa

ing instructors with electronics or communications equipment background at salaries of $3,825 and $4,600 a year. Jobs are available for engineering draftsmen beginning at $2,875 a year. Applications may be made at the Civilian Personnel Branch, Building T-530, Fort Monmouth, N. J.

Aluminum production now is about 17% above 1949, the Aluminum Association reports. The yearly rate now is running at approximately 1,450 million lb. July production was 127,035,442 lb of primary metal, compared to 120,800,774 in June.

Sangamo Electric Co has signed a one-year wage agreement with the International Association of Machinists covering 55 craftsmen in the maintenance division. The workers got a basic 5¢-an-hour wage boost plus an additional sum to be tied to the cost of living.

A manufacturing record for the household electrical appliance industry has been set by General Electric Co with production of its 30 millionth hand iron at Ontario, Calif. Approximately 35 million irons are in use in 37,750,000 wired homes today.

Large television picture tubes, 14 in. and over, now constitute more than 89% of cathode ray tube sales to TV receiver manufacturers, the Radio-Television Manufacturers Association reports. At the end of last year it was 15%.

•

Electric Storage Battery Agreement Ends Strike

Electric Storage Battery Co will resume full operations this week (Sept 18) at its two plants in Philadelphia following ratification of a new contract by members of Local 113 of the International Union of Electrical Workers, CIO.

The agreement ended a 14-week strike. Workers got a wage boost of 10½¢ an hour, which will cost the company about $480,000 a year, officials estimated. Other provisions included improved sickness and hospitalization benefits, eight paid holidays a year, a new pension program with payments ranging from $120 to $184 a month, and changes in severance pay policies.

Metal Prices
Sept. 18, 1950

COPPER, Conn. V., lb	$ 22½–24½
LEAD, N. Y., lb	.16
ZINC, prime Western, E. St. Louis, lb	.17½
TIN, Straits qual., N. Y., lb	1.01½
ALUMINUM, base price	.17½
NICKEL, base price	.48
STEEL, billets, Pitts., ton	53.00
STEEL scrap, No. 1 heavy, Pitts., ton	44.00

Hot idea for cooling off in Kansas

KANSAS summers are *hot*, as any Jayhawker knows; but one farmer figured a way to beat the heat! By pumping icy well-water into an old auto radiator and blowing air through it into his home, he found relief in a hurry! Another ingenious use for the greatest rural servant . . . electricity!

Wherever electricity spreads, you will find Hemingray Insulators, dependable always for efficient pole-line insulation.

No. 670 for 12,000-volt lines. The Technical Standards Committee of the Rural Electrification Administration has approved Hemingray Insulators No. 670, No. 680, and No. 514, under the limits of AIEE Specification No. 41 1944 for use on REA lines.

HEMINGRAY
POWER INSULATORS

American Structural Products Company
Muncie, Indiana
Subsidiary of Owens-Illinois Glass Company

NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Arizona-Nevada—Bureau Reclamation, Dpt. Interior, Phoenix, Ariz., installing overhead ground wires on Phoenix-Tucson No. 1, 11a-kilovolt transmission line, between Phoenix and Tucson, Davis Dam Proj., Spec. 3162.

Arizona-Nevada—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Boulder City, Nev., fabricated structural steel and sheave assemblies for Units A3, A4 and A9 and Bank Y and Nevada State Exten. for Hoover Switchyard, Boulder Canyon Proj. Spec. 3160; misc. structural steel for Units A3, A4, A5 and A9, and Bank Y, for Hoover Power Plant, Boulder Canyon Project, Spec. 3161, furnishing, del. f.o.b. cars shipping point or f.o.b. cars Boulder City Nev., 2 transformers and two 100 kw, 160 volt, 625 ampere, continuous rating, 0.256 ohm resistors, with 2 cover panels for covering the recess openings for Units A-3 and A-4, Hoover Power Plant, Boulder Canyon Proj., Spec. 3173.

Arizona-California-Nevada — Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing del. f.o.b. cars shipping point or f.o.b. cars Boulder City, Nev., misc. structural steel and handralling for Unit A-9, Hoover Power Plant, Boulder Canyon Proj., Spec. 3176. L. N. McClellan, ch. engr.

Md., Bethesda—Pub. Wks. Office, Potomac River Naval Command, Naval Gun Factory, Wash., D. C., alterations and addns. to electrical and ventilating facilities, Spec. 28289. Plans deposit $10.

Mich., Holland—City, P. Wks. Dpt., 1 story, brick, steel, concrete power plant addn. James B. Young Station. Giffels & Vallet, 1000 Marquette Bldg., Detroit, archts.

Missouri—Intercounty Electric Cooperative, Licking, 458.7 mi. rural distr. lines and 29.22 mi. conversion in Maries, Phelps, Dent, Texas, Shannon and Wright Counties. **$800,000.** Frank Horton & Co., Lamar, engr.

New York—Niagara Mohawk Power Corp., Electric Bldg., Buffalo, dam and hydro-electric power plant, Stewarts Bridge. **$5,600,000.**

N. Y., Middletown—Bureau Contracts & Accounts, Albany, power plant, Middletown, Homeopathic Hospital. Plans deposit $30.

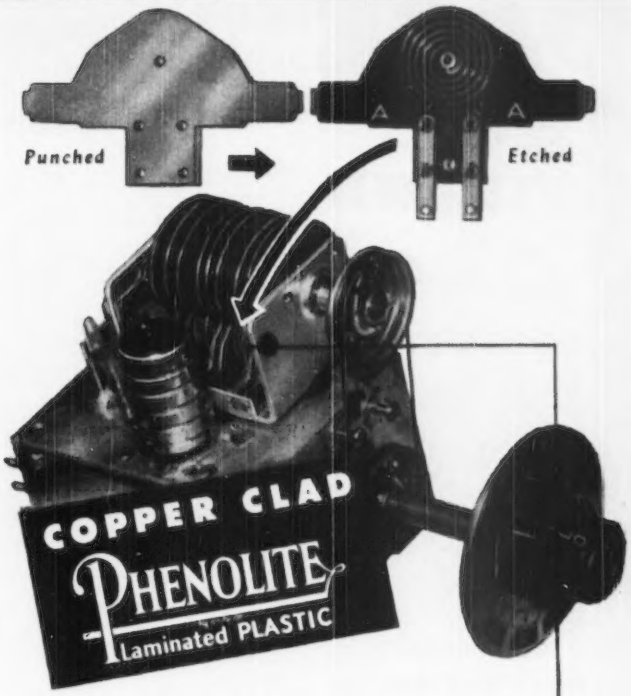
North Dakota—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., one 167 kva and one 25 kva transformer; one 46,000 volt circuit breaker, one 46,000 volt horn-gap switch, six 46,000 volt disconnecting switches, two 15,000 volt disconnecting fuses and 3 current transformers for Bismarck and Rugby sub-stations, Missouri River Basin Proj. Transmission Div., Spec. 3170.

North Dakota—Slope Electric Co-operative, New England, 194 mi. rural distr. lines, Bowman and Slope Counties. **$215,000.** Ulteig Eng. Corp., 1114½ Front St., Fargo, Engrs.

O., Niles—Ohio Edison Co., Walter H. Sammis, pres., 47 N. Main St., Akron, 200x250 ft., concrete, steel, brick steam-electric power plant on Mahoning River near here, 350 sq. ft. sub-station for transforming and switching facilities; 2 story, 30x60 ft. office, shop and storeroom sect. and screen house, etc. **$20,000,000.**

South Carolina—Broad River Electric Co-operative, Gaffney, 140 mi. rural distr. lines, Cherokee, Union and Spartanburg Counties. Plans deposit $10. J. B. McCrary Eng. Corp., 22 Marietta Street Bldg., Atlanta, Ga., engrs.

Tennessee—Forked Deer Electric Co-operative, Inc., H. E. Pentecost, mgr., Halls, warehouse and office. Plans deposit $100. Hart & McBryde, 2417 W. Eden Ave., Nashville, archts.



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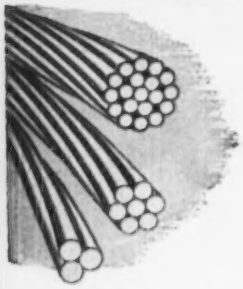

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Wyoming—Bureau Reclamation, Dpt. Interior, Casper, Wyo., constr. of Seminoe-Sinclair 115-kilovolt transmission line, Transmission-Div., Missouri River Basin Proj., near Sinclair, Spec. 3171. L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Low Bidders & Contracts Awarded

Colorado—Y-W Electric Assoc., Inc., Akron, 72 mi. rural distr. lines, Yuma Co., to J. R. Force Const. Co., 302 Natl. Bank of Topeka Bldg., Topeka, Kan. **$242,600.** Miner & Miner, 1825 Tenth Ave., Greeley, engrs.

Md., Baltimore—Consolidated Gas, Electric Light & Power Co., Lexington Bldg., Zone 1, exten. electric generating station, electric utility power house, turbine room and boiler house, steel, asbestos, 15x246 ft. high self supporting stack, 2105 Gould St. Owner builds. **$2,005,000.**

Md., Owings Mills—State, Dpt. P. Imprvts., 506 Park Ave., Baltimore, Zone 1, Sept. 6, power plant addn., alterations Rosewood State Training School, from Chas. T. King, 1017 Cathedral St., Baltimore, **$649,741.**

Mo., Fulton—Missouri Dpt. P. Health & Welfare, Sam Marsh, dir., Jefferson City, Aug. 25, power plant addn., from J. S. Alberici Constr. Co. 1556 Irving Ave., St. Louis, Zone 20, **$107,000.**

Nebraska—Custer Public Power Dist., Frank Haumont, pres., Broken Bow, 569.9 mi. rural distr. lines, Buffalo, Custer, Dawson, Logan and Sherman Counties, to Line Constructors, 544 Benson Bldg., Sioux City Zone 15, Ia. **$598,125***61.7** mi. rural distr. lines, Custer, and Lincoln Counties, to Crawford Electric Co., North Platte, **$164,059.** Bids 8/23.

N. J., Metuchen—Westinghouse Electric Corp., 40 Wall St., New York, N. Y., television mfg. plant, to Austin Co., 16112 Euclid St., Cleveland, O., **$4,000,000.**

Oklahoma—Tri-County Electric Cooperative, Inc., Hooker, Sect. 1, 305 mi. rural distr. lines serving 262 members; Sect. II, 205 mi. rural distr. lines serving 332 members, Texas Co., to Kennett & Pavlicek, Box 1305, San Angelo, Tex., **$363,969.** Carl C. Cox, 315 Barfield Bldg., Amarillo, Tex., engr.

Wis., Two Rivers—Paragon Electric Co., 1600 12 St., 1 story, 59x158 ft. steel, brick factory and office, to Hoffman Bros. Inc., 1816 10 St. F. W. Raeuber, 1024 S. 9 St., Manitowoc, archt.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ill., Melrose Park—International Harvester Co., 180 N. Michigan St., Chicago, Zone 1, 500,000 sq. ft. factory addn. **$3,000,000.**

Ky., Ashland—Armco Steel Corp., Ashland, expansion steel plant, **$15,000,000.**

Ky., Louisville—Phillip Morris & Co. Ltd., Inc., 1930 Maple St., plans by Lockwood Greene Engrs., Inc., engr. and archt., 10 Rockefeller Plaza, New York, N. Y. cigarette factory, warehouses, etc. **$6,000,000,** incl. equip.

Mo., Kansas City—Ford Motor Co., 3000 Schaefer St., Dearborn, Mich., assembly plant approx. 12 mi. north of downtown Kansas City, on 150 acre tract. Approx. **$25,000,000-$30,000,000.**

N. Y., Brooklyn—New York City Housing Auth., 62 Park Row, New York, Zone 7, Van Dyke Houses, 1,450 apartments on site bounded by Powell St., Stone, Sutter and Livonia Aves. **$19,000,000.**

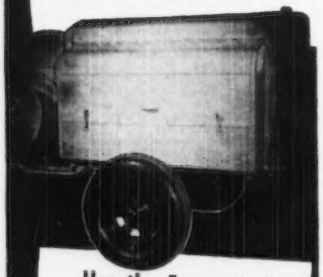
N. Y., New York—New York City Housing Auth., 62 Park Row, Zone 7, George Washington Houses, 1,512 apartments on site bounded by 97 and 104 Sts., Second and Third Aves. **$20,000,000.**

Pa., Pittsburgh—Westinghouse Electric Corp., Mahoney Bldg., 357 Blvd. of Allies, 1 story, brick steel mfg. plant in West Mifflin Twp. **$750,000.**

Low Bidders & Contracts Awarded

Calif., Beverly Hills—Beverly Hills Development Co., 145 S. Radio St., 4 story, rein.-con. department store, to Wm. Simpson Constr. Co., 816 W. 5 St., Los Angeles. Approx. **$4,000,000.** Paul E. Jeffers, 816 W. 5 St., Los Angeles, engr. J. W. Robinson Co., lessee.

Bring Compressor Costs Down!



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TECHNICAL LITERATURE

Conduit and Tubing—Three specification standards are available: *Rigid Steel Conduit Zinc Coated*, ASA C80.1-1950, 50¢; *Electrical Metallic Tubing Zinc Coated*, ASA C80.3-1950, 35¢; *Rigid Steel Conduit Enameled*, ASA C80.2-1950. They may be obtained from American Standards Assoc, Inc, 70 E. 45th St, New York 17, N. Y.

Natural Rubber—Charts and tables showing world production figures, prices, and consumption figures for natural rubber since 1939 are contained in a 64-page booklet, *Natural Rubber and You*. One section is devoted to historical and pictorial treatment of the subject. Natural Rubber Bureau, 1631 K St, N.W., Washington 6, D. C.

Lubricating Oils—"Viscosity" is the title of a six-part article appearing in the May and June issues of *Lubrication* magazine. First part illustrates the simplest concept of streamline flow between two surfaces having relative motion. Measurement of viscosity is illustrated. Part II covers streamline flow in capillary and other small tubes. Part III covers turbulent flow. Part IV goes into detail on effects of temperature and pressure on viscosity, and Part V includes Viscosity Index. A brief reference to the nature of plastic flow is given in Part VI. Copies may be obtained from The Texas Co, 135 E. 42nd St, New York 17, N. Y.

Watthour Meters—A 28-page booklet, *What it Takes for Long-Time Low-Cost Metering*, has a description of the various types of meters and their major fields of application. Factors discussed include: Separate unit construction; sustained meter accuracy; minimum maintenance; calibration; and corrosion resistance. Booklet B-4665 may be requested from Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Materials Handling—*Handbook of Material Handling with Industrial Trucks* is a 72-page practical guide for analysis of material handling operations and the application of the unit-load method with power-operated industrial trucks and accessories. Different types of skids, pallets, and other load carriers are illustrated and described. Single copies are priced at $1 (free to executives making request on company letterhead) from The Electric Industrial Truck Association, Dept PR, 2701 N. Broad St, Philadelphia 40, Pa.

Nickel Alloys—Two technical bulletins on properties of high nickel alloys contain charts, tables on compositions and properties, working instructions and other information. Bulletin T-7, *Engineering Properties of Inconel* also contains material on Inconel "X". Bulletin T-9 deals with engineering properties of "*K*" *Monel* and "*KR*" *Monel*. Both are available without charge from Technical Editor, The International Nickel Co, Inc, 67 Wall St, New York 5, N. Y.

Alloy Castings—An analysis of stainless, corrosion, and heat-resistant alloy castings is available in chart form. It also gives properties of the alloys at room temperature and at high temperatures, and discusses application of the alloys. Copies are available on request to Cooper Alloy Foundry Co, Hillside 5, N. Y.

Steel Castings—A technical chart is comprised of tabular listings of castings of structural grade carbon steels and engineering grade low alloy steels, classified according to tensile strength. Essential data include engineering and design applications, and current specifications for tensile grade requirements. Copies may be obtained from Steel Founders' Society of America, 920 Midland Bldg, Cleveland 15, Ohio.

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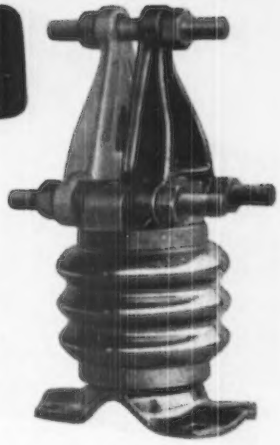

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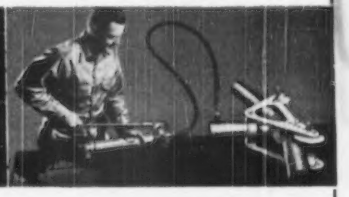

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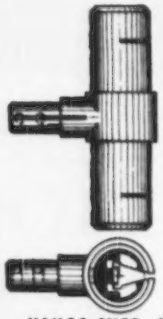
BOOK REVIEWS

Arc Welding Lessons for School and Farm Shop. By Harold L. Kugler. Published by the James F. Lincoln Arc Welding Foundation, Cleveland 1, Ohio. 343 pages, illustrated. Price $1.

This book was prepared to supply the need for basic instruction material for teaching vocational agriculture students at the high school level. It is suitable also for use in agricultural engineering shop mechanics courses as well as for use in shops on farms. The book contains 8 informational lessons providing general information on welding, 17 operational lessons intended to teach arc welding skills, over 75 welded shop projects and an illustrated glossary. The lessons can all be studied separately so that assignments can be made to one particular subject or the book can be studied as a complete course in arc welding. Each lesson, in addition to the presentation of information in the text, has a class outline which gives the lesson objective and suggests teaching techniques for achieving the objective. Key points for discussion and illustration are outlined. A step-by-step analysis of a typical job gives students a "learn by doing" method of reaching each lesson objective. Lessons cover such subjects as progress in arc welding, controlling distortion, selecting welding electrodes, protecting health through safe practices, striking an arc and running a flat bead, butt welding in flat position, welding in overhead position, welding sheet metal, welding cast iron, building up worn parts, shaping—bending—and forming metal with the carbon arc torch, hard-facing with arc welding equipment, etc.

Response of Physical Systems. By J. D. Trimmer. Published by John Wiley & Sons, Inc, New York 16. 268 pages, illustrated. Price $5.

Any engineers who wish they had had longer association with fundamentals of physics before they plunged into technical specialization will appreciate this book. It presents a degree of mathematical unification of the branches of engineering by taking samples from thermodynamics, hydraulics, radioisotopic production, nucleonic reactors, transients, stability, feed back, etc. for analysis through differential equations. The results indicate the value of recognizing the common principles underlying system-response in the several engineering categories and in cultivating the mathematical techniques which, in themselves, emphasize those common origins.



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CATALOGS • BULLETINS

● INSULATION PRODUCTS: A complete listing of electrical insulation products appears in a small 8-page booklet intended for easy reference. Insulation Manufacturers Corp, 565 W. Washington Blvd, Chicago 6, Ill.

● COMPENSATING TRANSFORMERS: Individual step-down transformers and voltage and frequency compensating transformers for office and factory equipment are covered in SD 179. Acme Electric Corp, Cuba, N. Y.

● EARTH BORING: Equipment for pole setting and earth boring is described in a bulletin on the company's new hydraulic controlled boring machine. Photographs illustrate uses of the machines. Sterling Engineering and Mfg Co, 173 Gilligan St, Wilkes-Barre, Pa.

● RANGE SALES: An illustrated 12-page promotion booklet is meant to help electric range dealers plan full scale advertising and promotion programs. Electric Appliance Div, Westinghouse Electric Corp, Mansfield, Ohio.

● MOTORS, GENERATORS, ETC: "Custom-Built Equipment for Industry", Bulletin 2-200, covers ac and dc motors and generators, m-g sets, frequency changers, battery chargers (including central station), and electrolytic power supplies. The Electric Products Co, 1725 Clarkstone Rd, Cleveland 12, Ohio.

● FENCE: "Copperweld Non-rusting Chain Link Fence" features applications of the fence for utility, industrial, and other purposes. Information on how to order is also given. Copperweld Steel Co, Glassport, Pa.

● RADIANT GLASS: Engineering properties, ratings, and applications of Pyrex Brand E-C radiant glass panels are covered in Bulletin B-86. Corning Glass Works, Corning, N. Y.

● PROTECTIVE COATINGS: Technical Service Data Sheet No. P-100-21 is a quick reference list of metal protective and paint bonding chemicals and processes. Inhibitors, metal cleaners, acid controls, etc are included. American Chemical Paint Co, Ambler, Pa.

● WELDED STEEL TUBING: Structural advantages, methods of fabrication, and characteristics of welded steel tubing are discussed in a 12-page booklet, "Armco Welded Steel Tubing." Armco Steel Corp, Middletown, Ohio.

● INDUSTRIAL CB's: Fully magnetic non-thermal, non-enclosed, general purpose circuit breakers are described in Bulletin 3410. Charts and illustrations Series overload, calibrating tap, shunt trip and relay trip coil connections are covered. Heinemann Electric Co, 98 Plum St, Trenton 2, N. J.

● CONTACT SWITCHES: Line drawings and charts in Bulletin CS give information about sizes, designs, and materials available in standard contact blades, lug adapters, and insulating separators. Guardian Electric Mfg Co, 1621 W. Walnut St, Chicago 12, Ill.

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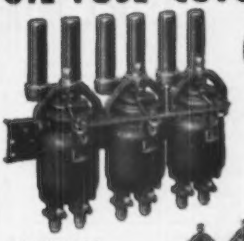

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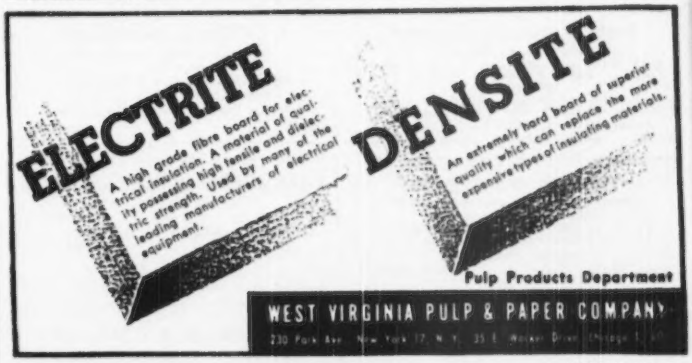
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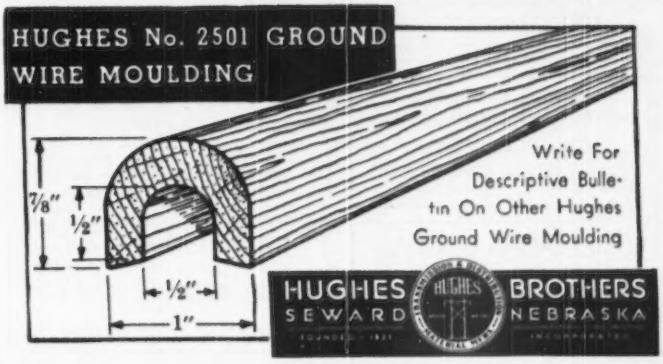

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320	*Al. Ch.	Dr. Prf	1.0	720
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LETTERS TO THE EDITOR

They Liked It

To the Editor of ELECTRICAL WORLD:

I am very much interested in the section "Selling Planned Lighting" which appears in the July 31 issue of ELECTRICAL WORLD, and I wonder if reprints of this section are available. If so, I would like to purchase some copies for our salesmen.

P. M. Alden,
Manager

Philadelphia Electric Co
Philadelphia 5, Pa.

To the Editor of ELECTRICAL WORLD:

When reprints of your July 31 feature on Planned Lighting are available, I will appreciate your sending me fifty (50) copies as quickly as possible. I want to put one into the hands of each of our sales people calling on commercial and industrial customers.

Please send the statement, as well as the package, to my attention.

We like your story very much this year. We believe your decision to write it to the men on the firing line was wise. You are to be congratulated.

F. M. Kimball,
General Sales Manager

Kansas Gas & Electric Co
Wichita 1, Kansas

To the Editor of ELECTRICAL WORLD:

I have just had an opportunity to read the July 31st issue with the Planned Lighting stories. They were most interesting and I would like to send copies to all of our lighting people, particularly pages 79 through 94. If there are are reprints of this section available, we would like to obtain 25. If not, we would like to purchase 25 copies of the July 31st issue of the ELECTRICAL WORLD. Would you please let me know if the reprints are available and at what price.

John S. Walsh,
Chief Illuminating Engineer

Pacific Gas & Electric Co
San Francisco, Calif.

To the Editor of ELECTRICAL WORLD:

I certainly want to compliment you and ELECTRICAL WORLD on the excellent July lighting issue with special emphasis on Planned Lighting. It is my feeling that this section will not only be of interest to commercial managers, but exceedingly helpful to their men.

As you may know, we are ordering a quantity of reprints to bring it to the special attention of electric utility commercial executives to make certain they do not miss reading it and passing it along to their co-workers.

We feel that you have struck on a new idea with a different approach from which you should receive excellent reaction. Naturally, we are grateful to you for the importance placed on Planned Lighting activity in which we are tremendously interested.

James T. Coatsworth,
Commercial Director

Edison Electric Institute
New York, New York

To the Editor of ELECTRICAL WORLD:

You had a splendid resume on selling Planned Lighting in the July 31st issue of the ELECTRICAL WORLD.

Will you advise if it is possible to get reprints, and, if so, what the charge would be.

John G. Waddell
Managing Director

Electric Institute of Boston, Inc
Boston, Mass.

To the Editor of ELECTRICAL WORLD:

We would like to offer our congratulations on another excellent article on illumination in your July issue under the subject "Selling Planned Lighting". We would very much like to obtain additional copies of this article to circulate to our entire illumination sales personnel and we would appreciate it if you would indicate whether reprints are available. We would require approximately 25 copies. Would you please advise what these reprints would cost and if they are not available whether complete issues of the ELECTRICAL WORLD for July are obtainable and also what these would cost us.

Your early attention to this matter would be very much appreciated.

R. A. Eshelby
Sales Supervisor

Northern Electric Co
Montreal, Que.

(Editor's Note: These letters are typical of reader reaction to the feature, "Selling Planned Lighting" in ELECTRICAL WORLD, July 31.)

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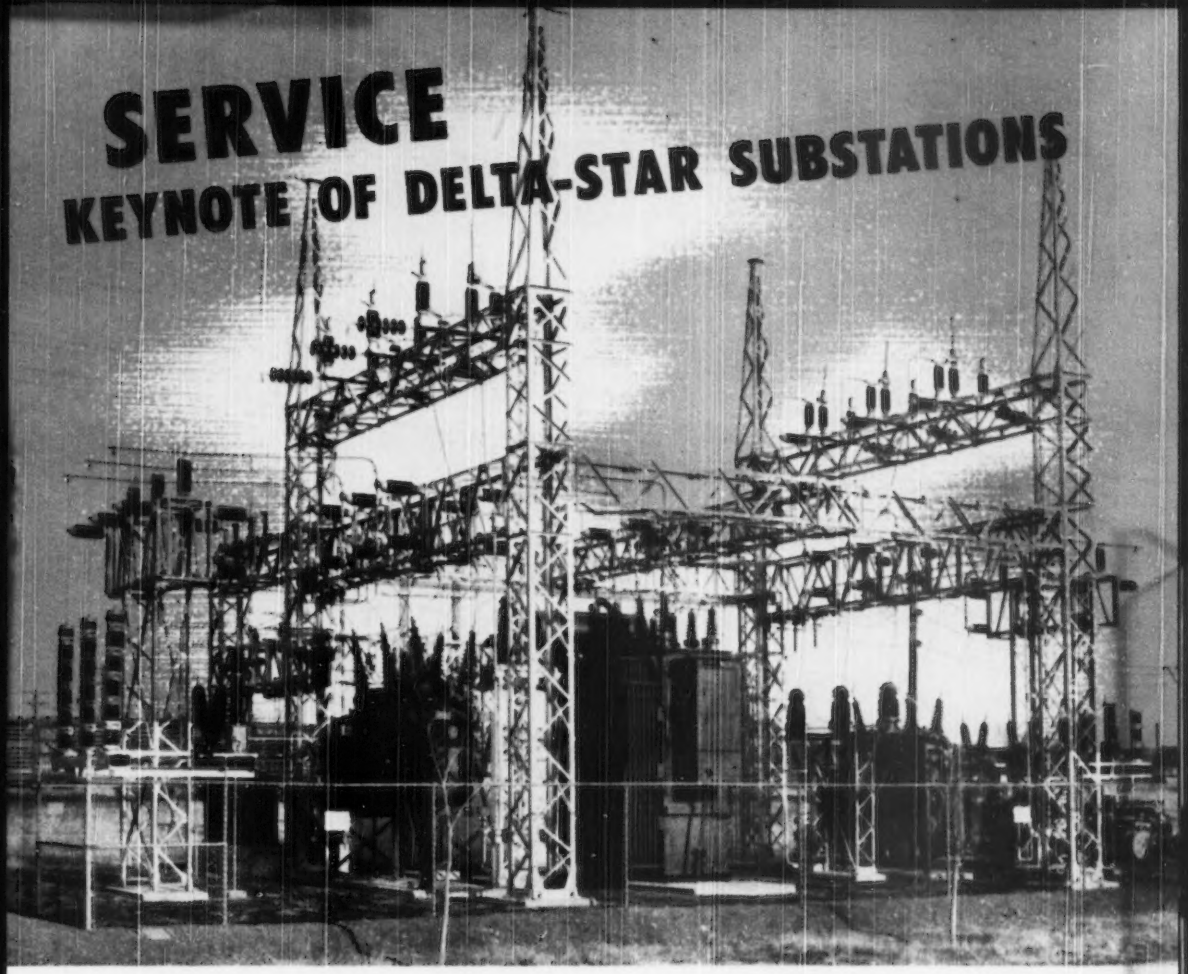

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San Francisco, Cal.
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Tampa, Fla.
Washington, D. C.
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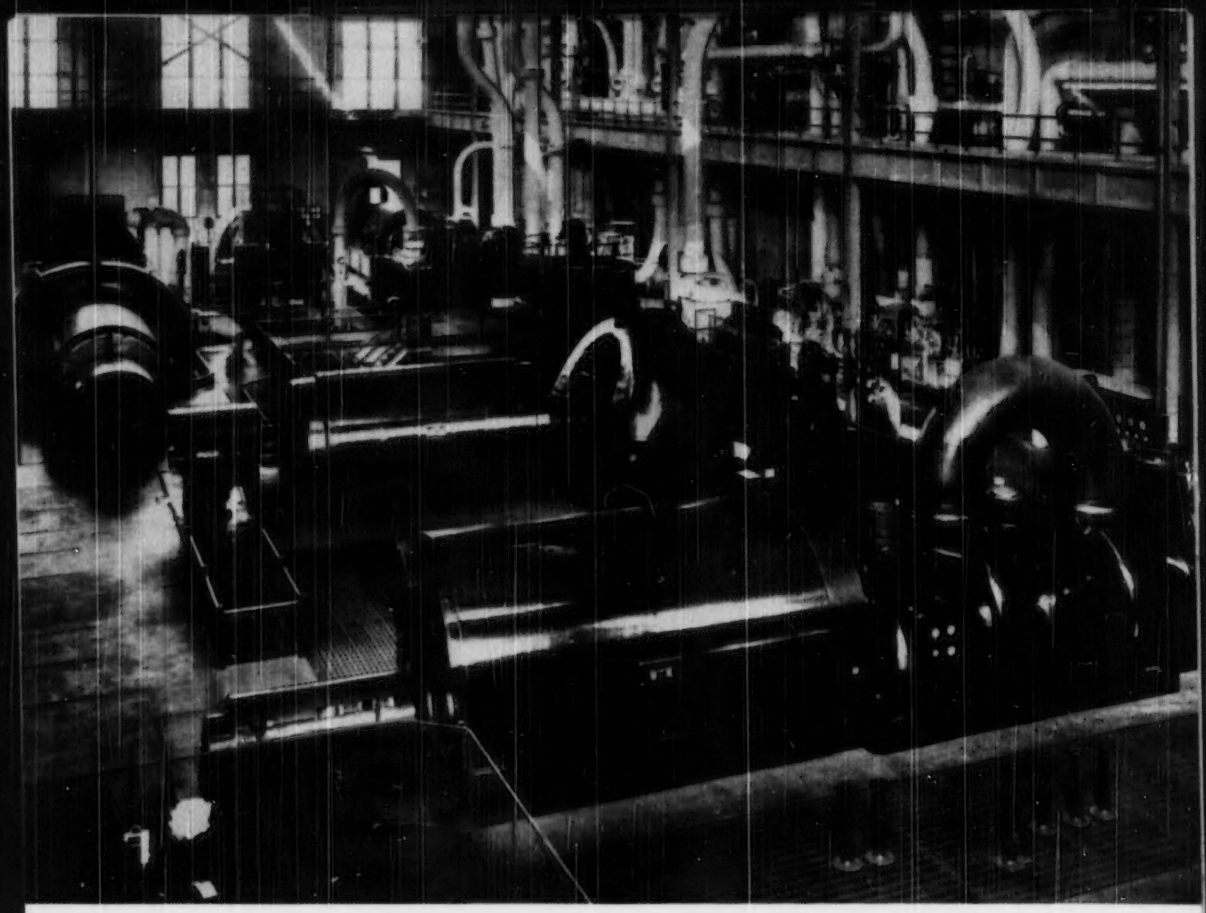
CANADIAN ASSOCIATE

Canadian Line Materials Limited — Toronto 15, Canada



Turbines in the Kansas City Power and Light Company's Second and Grand station: a 10,000-kw., a 11,500-kw., a 20,000-kw., and two 35,000-kw. units, all lubricated with NONPAREIL Turbine Oil.

Turbines stay on the job, so does ➡ ➡ ➡

USED first in a 20,000-kw. turbine in 1936, NONPAREIL Turbine Oil today lubricates five turbines, totaling 111,500 kw., in the Kansas City Power and Light Company's Second and Grand station. Reason for this acceptance is easy to find in the oil's low acidity records.

In the oldest fill (14 years), the neutralization number has not exceeded 0.10 mg. KOH/gm., and in all five fills it has averaged only 0.07 mg. KOH/gm. The consistently low acidity of NONPAREIL has kept turbines on the job and minimized maintenance time.

Gain these advantages by using NONPAREIL in your turbines: no oil replacements, no removal of oil for treatment, no cleaning of oil systems and governors. For evidence of these advantages, ask a Standard Oil lubrication specialist to supply you performance data from the 20-year service record of NONPAREIL Turbine Oil.

NONPAREIL
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Turbine Oil

You can reach a lubrication specialist through the nearest local Standard Oil (Indiana) office or by writing:

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

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